Public Health Reports

Vol. 56 • **JULY 11, 1941** • *No. 28*

HOSPITAL MASKS: THEIR BACTERIAL FILTERING EFFICIENCY AND RESISTANCE TO AIR FLOW [1]

A COMPARATIVE STUDY

By ROLAND ROOKS, LEWIS J. CRALLEY, and M. E. BARNES

The possible occurrence of pneumonia and epidemic meningitis in our Army camps makes adequate masking a timely topic. Weaver (*1*) was able to show that by masking of nurses and physicians, nasopharyngeal cultures failed to reveal a single carrier among those caring for meningitis patients. He suggests "that it might be used to advantage also by persons caring for pneumonia patients."

The increased interest in the bacterial counts of operating room air and attempts made to sterilize this air have led to further questioning as to the bacterial filtering efficiency of surgical masks. Secondary infections of "clean" surgical cases are not uncommon (*2, 3, 4, 5*). Walker (*6*) found that in a series of deaths due to hemolytic streptococcus infections following operations on patients who should have had "clean" wounds, half of the nursing personnel were carriers of hemolytic streptococci. He states, "again, study of the masks revealed that they were woefully inefficient, as far as they could be considered germ proof. In the absence of other positive evidence, it seemed fair to deduce that this epidemic of streptococcus infection was probably due to streptococci carriers inefficiently masked." Davis (*7*) suggests that adequate masking is not only essential but is the most important procedure, in addition to rubber gloves and gentle handling of tissues, that the surgeon can personally carry out to prevent infection in clean operative wounds. In a recent review of this subject, Hart and Schiehel (*8*) conclude that "sufficient evidence has been brought forward to indicate that the bacteria in the nose and throat of the operating team and of the gallery have distinct possibilities in regard to the infection of wounds. It is obligatory upon the individuals to cover the oral and nasal orifices with adequate masks."

The wide variety in design and material of face masks in actual use reflects in part the lack of conclusive experimental results on the

[1] From the Department of Hygiene and Preventive Medicine, State University of Iowa, Iowa City, Iowa.

bacterial filtering efficiency. In the light of the newer concept of droplet infection the usual testing technique of exposure of Petri dishes containing a desirable culture medium during reading or coughing would not appear to be adequate, especially when these plates were not exposed for a sufficient time to allow all possible "droplet nuclei" to settle from the air. Various impermeable types of masks have been suggested (*9*, *10*), but again from the standpoint of "droplet nuclei" these masks would not appear to be adequate. It would seem that the best possible mask is one that acts as a filter. As suggested by Arnold (*11*), "Covering the nose and mouth with an impermeable material deflects the expired air all around the edges of the mask, and the atmospheric pollution is the same as if no mask were worn."

Preliminary experiments show that bacteria do tend to escape around the impermeable type of face mask. These results and additional experimentation on face masks will be reported in a separate paper.

The two problems with which we were immediately concerned and which are reported in this paper are, first, to determine the bacterial filtering efficiency of various textiles and materials; second, to determine the actual resistance to air flow of these same materials.

It was felt that, after the solution of the above two problems, it should be possible to devise a surgical mask of satisfactory type such that in use most of the air would be forced through the mask and not around it.

In beginning this study the technique used by Arnold (*11*) was employed. A 6-inch funnel (covered with the material to be tested) was attached to the Wells air centrifuge intake. It was found, however, that when this air centrifuge is used to pull against air friction such as is produced by covering the funnel with material, the manometer and tube readings become unreliable. When resistance is applied to the intake of the centrifuge in this manner the manometer readings remain the same, although obviously less air is passing through the instrument. As will be pointed out subsequently, our results confirm in part those of Arnold when the materials tested had approximately the same resistance to air flow.

APPARATUS

Experimental chamber.—In order to aid in the control of bacterial dosage an experimental chamber was devised as shown in figure 1. This chamber is constructed of "galvannealed" sheets, painted after construction with aluminum paint. It is of sufficient size (6 feet by 5½ feet by 2½ feet) to enable the necessary testing equipment used to be placed inside this chamber. The chamber can be easily raised and

lowered through the use of counterweights. An opening at one end to which is attached a small vacuum pump makes possible a complete change of air in the chamber in 30 minutes. The air is drawn by means of this pump through a small incinerator and then released into an exhaust hood. A window with necessary lighting makes observation of readings possible from outside the chamber. An oil seal at the base

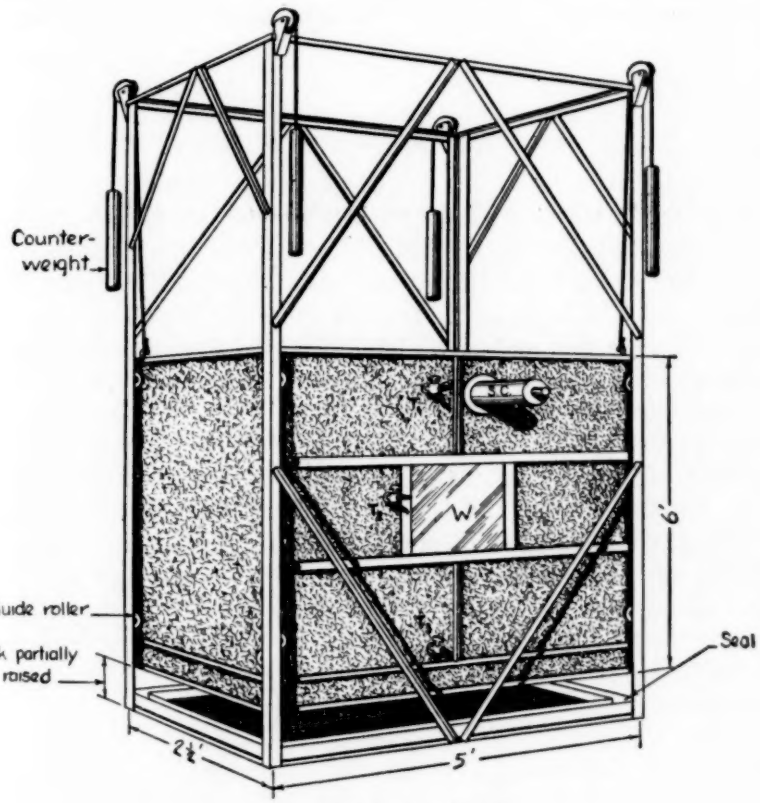

FIGURE 1.—Experimental chamber.

makes the chamber airtight at atmospheric pressures used. Additional points in construction are not of concern in this problem.

Resistance of material to air flow.—Sternstein (*12*) has developed a rapid method of measuring nasal resistance by determining this resistance in terms of air flow. This method was modified to measure resistance of various possible mask materials as shown in figure 2. The material to be tested was placed tightly over the rim of funnel *G*. With valve *E* closed, air flow was created by vacuum pump *P*. This air flow was measured on manometer M_4 and resistance in terms of a suitable flowmeter M_3.

Bacterial filtering efficiency of tested material.—The apparatus used to determine the bacterial filtering efficiency is also shown in figure 2.

The same vacuum pump is used. Manometer M_4 is used to measure total air flow; M_1 and M_2 are flowmeters used to balance the air intake through the "funnel devices" (*13*) *A* and *B*, with valves *C* and *D* used to control this intake. The material to be tested was placed in such a way over a funnel that all of the air was forced through this material. The funnel was then attached to the intake of *A* or *B*. Cultures of *B. prodigiosus* (*S. marcescens*) were sprayed into the air by means of compressed air. The bacteria were impinged on Petri dishes containing nutrient agar. The difference in bacterial count indicated the filtering efficiency.

PROCEDURE

Resistance of material tested to air flow.—With valve *E* closed, the vacuum pump was turned on until flowmeter M_4 showed 9 liters of air per minute being drawn through funnel *G*. The resistance on M_3 was then recorded in millimeters of water. Funnel *G* was then covered with the material to be tested in such a manner that all of the air was drawn through this material. The increased resistance as shown by flowmeter M_3 was recorded. The difference between these two readings was used as an expression of resistance to air flow in millimeters of water. A small funnel area makes flowmeter M_3 much more sensitive. For this reason this funnel, as well as the funnel attached to the "funnel device" to determine the bacterial filtering efficiency, measured 1½ inches. With the rate of air flow used (9 liters per minute) and a small funnel area, flowmeter M_3 was very sensitive to slight changes in resistance. With materials which were considered to have about the same resistance when tested by attempting to breathe through them, it was possible by this method to show marked differences.

Bacterial filtering efficiency of tested materials.—All readings on the bacterial filtering efficiency of the various materials tested were taken with the testing equipment (fig. 2) inside the experimental chamber. A funnel was first attached to the intake of each "funnel device," *A* and *B*. The material to be tested was placed over one of the funnels so that all of the bacteria in the air would be drawn through this material. The vacuum pump (*P*) was turned on with valve *E* open and valve *F* closed until flowmeter M_4 registered 9 liters of air per minute. By means of valves *C* and *D* necessary adjustments were made until the two manometers, M_1 and M_2, showed an equal amount of air being drawn through each sampling device. Although maximum sampling efficiency of the "funnel device" is reported (*13*) for a faster rate of air flow, inasmuch as the same rate was maintained through the material tested as the control, the sampling efficiency remained the same.

After balancing the air intake through each "funnel device" the chamber was closed. Additional procedures, such as spraying of the test organism, starting and stopping the vacuum pump, and taking manometer readings, were carried out by the investigator outside the chamber. The test organism (*B. prodigiosus*) was sprayed into the chamber and the vacuum pump was turned on 6 seconds after spraying. Theoretically all readings were then in terms of "droplet

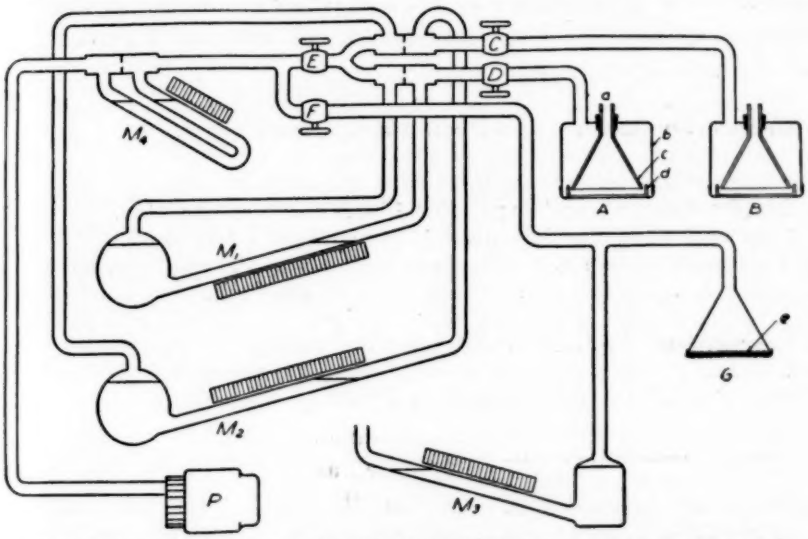

FIGURE 2.—Apparatus for measuring the bacterial filtering efficiency and resistance of materials.

nuclei" (*14*). It was believed that there would be a more equal distribution of bacteria throughout the chamber by testing after 6 seconds than if tests were taken during or immediately after spraying. The bacterial dosage was maintained between 100 and 200 bacteria per cubic foot of air sampled. As the results were very consistent, ordinarily a series of five readings were taken on each material tested except when the bacterial dosage was not maintained, in which case an additional five readings were made. The total testing time of each reading was 5 minutes. The exhaust from the vacuum pump acted as a fan to help maintain as uniform a distribution of organisms within the chamber as possible. During spraying, both funnels were so covered that "droplets proper" could not gain entrance into the sampling device.

DISCUSSION AND RESULTS

Although various studies have been reported on the efficiency of gauze masks (*14*, *15*, *16*, *17*), no one appears to have determined the effect of laundering [2] on this efficiency. The bacterial filtering efficiency and resistance to air flow of the ordinary 2-layer new gauze

[2] The standard commercial process.

mask was first studied. It was found to have a resistance to air flow of 1.0 millimeter of water and a bacterial filtering efficiency of 23 percent. After each series of 5 washings, gauze masks of various layers, as shown in table 1, were tested. It was found that maximum filtering efficiency and resistance to air flow were reached on 20 washings. Further tests were carried out until these materials were washed 50 times, with the results as shown in table 2. The 6-layer gauze mask at this time showed a resistance to air flow of 6.0 millimeters of water and a bacterial filtering efficiency of 97 percent.

TABLE 1.—*Classification and description of materials tested* [1]

1. Gauze (42 by 42 strands per inch), 2, 3, 4, 5, and 6 layers.
2. 2 layers of gauze with ¼-inch air space between.
3. 2 layers of gauze containing thin [2] layer of absorbent cotton.
4. 2 layers of gauze containing medium [2] layer of absorbent cotton.
5. 2 layers of gauze containing thick [2] layer of absorbent cotton.
6. Commercial Mask No. 1: 4 layers of gauze (31 by 27 strands per inch).
7. Commercial Mask No. 2: A single layer of canton flannel, double-phased, napped on both sides, 65 by 46 strands per inch, placed inside thin gauze.
8. Commercial Mask No. 3: Constructed of a single layer of broadcloth.
9. Cellucotton (Lewis Manufacturing Co., Walpole, Mass.).
10. Flannel (wool): A virgin flannel having 42 by 42 strands per inch (Amana Woolen Mills, Amana, Iowa).
11. Flannel (cotton): Medium weight, outing flannel, plain weave, napped on both sides, 46 by 42 strands per inch.
12. Rayon: Air spun rayon, 85 by 58 strands per inch.
13. Silk: Pure dye silk, flat crepe.

[1] As verified by Assistant Professor Merle Ford, Home Economics Department, State University of Iowa, Iowa City, Iowa.

[2] Thin=.024 gm. per sq. inch.; medium=.041 gm. per sq. inch; thick=.085 gm. per sq. inch.

In an attempt to devise a mask utilizing this same material in a different manner, additional tests were carried out. The 2-layer gauze mask was tested with an air space of one-fourth inch between the 2 layers of gauze. It was believed that this might possibly increase the bacterial filtering efficiency without changing the resistance to air flow. Tests showed, however, that with this spacing no such increase was shown (table 2).

TABLE 2.—*Bacterial filtering efficiency and resistance to air flow of gauze masks*

	Filtering efficiency	Resistance to air flow, in millimeters of water
	Percent	
2 layers (washed 50 times)	74	2.0
3 layers (washed 50 times)	79	3.0
4 layers (washed 50 times)	88	4.0
5 layers (washed 50 times)	93	5.0
6 layers (washed 50 times)	97	6.0
2 layers (washed 50 times) with ¼-inch air space between layers	70	2.0
2 layers (washed 50 times) containing thin layer of absorbent cotton	89	3.5
2 layers (washed 50 times) containing medium layer of absorbent cotton	92	4.0
2 layers (washed 50 times) containing thick layer of absorbent cotton	97	6.5

Additional tests were carried out with the 2-layer gauze mask, placing within this mask layers of absorbent cotton of varying thickness (table 1). A relatively thick layer of absorbent cotton gave results comparable to the 6-layer (washed) gauze mask.

Three commercial masks were next studied, all of them utilizing different materials in construction (table 1). The first mask was made of 4 layers of gauze (31 by 27 strands per inch). As this was a coarser material than the gauze previously studied, additional tests were not carried out. Mask No. 2 gave a high resistance to air flow (11.0 millimeters) but also showed a high filtering efficiency (98 percent). After washing 50 times the resistance to air flow was increased to 15.5 millimeters of water with a further increase in the bacterial filtering efficiency to 99 percent. It is believed that further study will show that a mask having such a high resistance will allow escape of bacteria around the mask. The third commercial mask made of broadcloth (single layer) had a very high resistance to air flow (15.0 millimeters) and a relatively low filtering efficiency (41 percent).

Arnold (*11*), using a different testing technique, has reported a 100-percent bacterial filtering efficiency for 6 layers of cellucotton. He also suggested that the resistance to air flow was less for cellucotton than for gauze, although this factor was apparently not measured. Our results confirm in large part the findings of Arnold. We found that 8 layers of cellucotton gave a bacterial filtering efficiency of 97 percent, with a lower resistance than 6 layers of gauze (table 3). If cellucotton is to be used in masks, some suitable means for holding it in place must be considered. This problem, and the difficulty of sterilizing it, constitute disadvantages to be overcome.

TABLE 3.—*Bacterial filtering efficiency and resistance to air flow of other materials tested*

	Filtering efficiency	Resistance to air flow in millimeters of water
	Percent	
Cellucotton (8 layers)	97	4.0
Amana wool (1 layer washed 50 times)	100	13.5
Cotton flannel (1 layer, medium weight, washed 50 times)	98	11.0
Air spun rayon (2 layers washed 50 times)	92	8.5
Silk (flat crepe, single layer)	83	8.5

That there is a marked difference in the filtering efficiency of different materials when comparison is made with resistance is indicated in table 3. Although "Amana" wool gave a high filtering efficiency, the resistance to air flow after washing would appear to be too high to make this material suitable for mask construction.

In table 4 are shown the materials which according to this testing technique appeared to have the greatest possibilities in mask construction. Although most studies have indicated a very low

efficiency for gauze masks, our results show that the structure of this material is so changed by laundering as to make it a relatively good material, although not as desirable as cellucotton in bacterial filtering efficiency and resistance to air flow.

TABLE 4.—*Bacterial filtering efficiency and resistance to air flow of materials showing greatest possibilities for mask construction*

	Filtering efficiency	Resistance in millimeters of water
	Percent	
Cellucotton (8 layers)	97	4.0
Gauze (42 by 42 strands per inch, 6 layers, washed 20 times)	97	6.0
Gauze (42 by 42 strands per inch, 2 layers, washed 20 times, containing a single layer of thick absorbent cotton)	97	6.5

Theoretically, it might be expected that a certain optimum point might be reached from the standpoint of resistance to air flow and filtering efficiency beyond which, as the resistance to air flow increases, there is a greater tendency for bacteria to escape into the air around the mask. If this optimum can be determined, then it should be possible to develop a mask that will give a high filtering efficiency as shown by actual use. Research from this standpoint and additional factors in mask construction are to be reported in a separate paper.

CONCLUSIONS

A series of studies made on materials varying in structure and composition in which it was possible to measure the bacterial filtering efficiency and the resistance to air flow of these same materials appear to justify the following conclusions:

1. The laundering of gauze enormously increases the bacterial filtering efficiency with only a slight increase in its resistance to air flow.

2. The maximum bacterial filtering efficiency of gauze masks is reached after 20 periods of laundering.

3. A 6-layer gauze mask (42 by 42 strands) after 20 launderings showed a 97-percent bacterial filtering efficiency.

4. Of the various materials tested, cellucotton showed an advantage insofar as high bacterial filtering efficiency and low resistance to air flow are concerned. Certain disadvantages to its use in masks exist.

5. Materials having the same resistance to air flow vary widely in their bacterial filtering efficiency.

ACKNOWLEDGMENTS

The materials tested in these studies were secured by purchase, except the commercial and hospital masks which were supplied by David W. Stickney of the Lewis Manufacturing Co., T. R. Ponton,

M. D., editor of Hospital Management, and R. J. Connor, assistant administrator, University Hospitals, Iowa City. Mr. L. A. Bradley, manager of the university laundry, handled the details involved in the repeated laundering of the materials studied.

REFERENCES

(1) Weaver, George H.: The value of the face mask and other measures in prevention of diphtheria, meningitis, pneumonia, etc. J. Am. Med. Assoc., **70:** 76–78 (January 1918).
(2) Cairns, Hugh: Bacterial infection during intracranial operations. Lancet, **1:** 1193–1198 (May 1939).
(3) Ives, Howard R., and Hirshfeld, John W.: The bacterial flora of clean surgical wounds. Ann. Surg., **107:** 607–617 (April 1938).
(4) Overholt, Richard H., and Betts, Reeve H.: A comparative report on infection of thoracoplasty wounds. J. Thoracic Surg., **9:** 520–529 (June 1940).
(5) Meleney, F. L.: Infection in clean operative wounds. Surg. Gyn. and Obstet., **60:** 264–275 (February 1935).
(6) Walker, I. J.: How can we determine the efficiency of surgical masks? Surg. Gyn. and Obstet., **50:** 266–270 (January 1930).
(7) Davis, John S.: Is adequate masking essential for the patient's protection? Ann. Surg., **105:** 990–997 (June 1937).
(8) Hart, D., and Schiehel, H. M.: Role of the respiratory tract in contamination of air; a comparative study. Arch. Surg., **38:** 788–796 (April 1939).
(9) Tottenham, R. E.: A new operating mask. Brit. Med. J., **1:** 756 (April 1936).
(10) Mellinger, H. V.: New mask that protects both physician and patient. J. Am. Med. Assoc., **45:** 662–663 (August 1930).
(11) Arnold, Lloyd: A new surgical mask. A bacteriologic air filter. Arch. Surg., **37:** 1008–1016 (December 1938).
(12) Sternstein, H. J.: Quantitative study of nasal obstruction. Arch. Otolaryngol., **23:** 475–479 (April 1936).
(13) Hollaender, Alexander, and DallaValle J. M.: A simple device for sampling air-borne bacteria. Pub. Health Rep., **54:** 574–577 (April 7, 1939). Reprint No. 2055.
(14) Gautheir, P. P.: A comparative study of three surgical masks. Canad. Med. Assoc. J., **37:** 250–252 (September 1937).
(15) Leete, H. Mason: Some experiments on masks. Lancet, **1:** 392–393 (March 1919).
(16) Doust, B. C., and Lyon, A. B.: Face masks in infections of the respiratory tract. J. Am. Med. Assoc., **71:** 1216–1219 (October 1918).
(17) Blatt, M. L., and Dale, M. L.: A bacteriological study of the efficiency of face masks. Surg. Gyn. and Obstet., **57:** 363–368 (September 1933).

PUBLIC ACCIDENTS AMONG THE URBAN POPULATION AS RECORDED IN THE NATIONAL HEALTH SURVEY[1]

By JOAN KLEBBA, *Junior Statistician*, and ROLLO H. BRITTEN, *Senior Statistician*, *United States Public Health Service*

In the United States more than 50,000 accidental deaths occur annually in public places (streets, highways, buildings, parks, beaches, etc.).[2] These deaths account for 4 percent of all deaths and 50 percent of all accidental deaths in the country. Moreover, public accidents

[1] From the Environmental Sanitation Section of the Division of Public Health Methods, National Institute of Health. Acknowledgment for assistance in the preparation of this article is made to David E. Hailman and James S. Fitzgerald. Assistance in the preparation of these materials was furnished by the personnel of Work Projects Administration Official Projects Nos. 712159-658/9999 and 765-23-3-10.

[2] Based on an average of the number of deaths occurring in the years 1935-38 as reported by the U. S. Bureau of the Census.

rank high among all causes of death due to disease and accident as well as among all fatal accidents, being the cause of more than one-third as many deaths as all infectious and parasitic diseases combined (including among others, tuberculosis, typhoid fever, smallpox, measles, scarlet fever, whooping cough, diphtheria, influenza, poliomyelitis, and meningitis) and of more than diabetes and appendicitis combined. Almost five times as many fatal accidents occur in public places as occur in industry, and over twice as many as in the home.[3]

Motor-vehicle accidents are by far the most important means of accidental deaths occurring in public places, causing approximately 70 percent of all fatal public accidents.

Further evidence of the seriousness of public accidents is provided by data collected in the National Health Survey (1935–36),[4] which includes information relating to the frequency and amount of disability resulting from public accidents, fatal[5] and nonfatal, occurring within the 12 months immediately preceding the enumerator's visit.

The purpose of the present report is to describe the material collected in the National Health Survey on public accidents (among 2,498,180 white and colored persons of known age, or 3.6 percent of the urban population of the United States (1930)).[6] Specifically, it

[3] Average annual number of deaths (based on number of deaths occurring in the years 1935–38 as reported by the U. S. Bureau of the Census) according to specified cause is as follows:

Cause of death	Average for years 1935–38
All infectious and parasitic diseases	141,320
Diabetes	30,099
Appendicitis	15,566
Accidents	102,209
Industry	10,178
Home	23,738
Public (including average of 34,256 for motor vehicles)	49,272
Unspecified as to place of occurrence	19,021

[4] Perrott, George St. J., Tibbitts, Clark, and Britten, Rollo H.: The National Health Survey: Scope and method of a Nation-wide canvass of sickness in relation to its social and economic setting. Pub. Health Rep., 54: 1663 (1939). Reprint No. 2098.

[5] Ibid., p. 1671. As pointed out in this previous report, it has been known since the U. S. Census of 1850 that mortality data obtained in house-to-house canvasses are particularly subject to underenumeration. Disappearance of single-person households, breaking up of other households, lack of coverage of orphanages, homes for the aged, and other institutions in which the death rates are particularly high, and the difficulty of establishing the concept of reporting on past members of the household, are some of the factors which result in abnormally low death rates.

For these reasons fatal accident cases are not presented separately. However, in order to give as complete figures as possible in regard to serious accidents occurring within the study year, they are combined with the nonfatal cases in the frequency and disability rates.

Fatal and hospitalized cases even of less than 7 days of disability before termination or recovery are included.

[6] The sample was chosen to be representative in general of cities in the United States according to region and size. In large cities (100,000 and over) the population to be canvassed was determined by a random selection of many small districts based on those used in the U. S. Census of 1930. In the smaller cities selected for study the population was enumerated completely. See article by Perrott, Tibbitts, and Britten cited in footnote 4 for a more detailed account of the sampling procedure and a comparison of certain characteristics of the population enumerated with those of the urban population as a whole (Census, 1930).

The survey, covering over 700,000 urban households in the United States, followed established techniques. Trained enumerators were employed to obtain the information from the housewife or other responsible member of the household.

presents the frequency of public accidents disabling for 1 week or more by age, sex, economic status, means of injury, and size of city, and the days of disability per person and average duration of periods of disability by age.[7]

Definition of public accident.—Only those accidents [8] which the enumerator recorded as fulfilling the following requirements as to place of occurrence and resulting disability are included in the present report:

(1) The place of occurrence must have been on a public street or highway, or in other public place.[9] Regardless of whether the injury arose out of or in the course of gainful employment, if the injured person was operating, riding in, or struck by a motor vehicle used in land transportation, the event is included with those occurring in a public place.

(2) The event must have resulted in disability (that is, inability to work, attend school, care for the home, or engage in other customary activity) lasting 1 week or more within the 12 months immediately preceding the visit or in hospitalization or death.[10]

In addition to the means of injury (or death) commonly thought of in connection with public accidents, such as a collision between vehicles, public or private, falling of building construction material on a pedestrian, attack by a venomous animal, and drowning at a public beach, other means, such as poisonous food served in a public eating place, heat exhaustion, and lightning (but not a brawl or suicidal attempt resulting in injury) are included.

Frequency of public accidents.—The annual frequency of public accidents (sole, primary, and contributory causes [11]) which disabled

---

[7] For a summary of data obtained on illnesses and accidents, see Britten, Rollo H., Collins, Selwyn D., and Fitzgerald, James S.: The National Health Survey: Some general findings as to disease, accidents, and impairments in urban areas. Pub. Health Rep., 55: 445 (1940). Reprint No. 2143.

[8] For accidents (and for impairments resulting from accidents) the enumerator entered on the schedule the means of injury (such as burn, fall, etc.) and whether the accident occurred at home, at work, or in a public place. The 1929 Revision of the International List of the Causes of Death, with some modifications, was used as a basis for classification of means of injury as recorded by the enumerator.

[9] A small number of accidents involving a motor vehicle are classified as public accidents (459, or 3 percent of a total of 16,282) even though unspecified as to place of occurrence (16 cases), or reported as occurring on residential property (98 cases), or in a railroad shop or yards or other industrial work place not open to the public (345 cases).

[10] Accidents causing disability on the day of the interview (whether or not the disability had attained a duration of 1 week or more) were also recorded. Thus two indices of the frequency of public accidents are obtainable: (*a*) An annual frequency rate of periods of disability of 1 week or more, and (*b*) the proportion of persons disabled on the day of the visit. Only the former index, however, is used in this report.

Except for accidents which caused disability on the day of the visit or resulted in hospitalization or death, no attempt was made to obtain a record of those which disabled for less than 1 week.

A nominal number of accidents which caused disability of at least 7 days within the 12-month period, but occurred prior to it, have been included.

[11] For a discussion of classification of disability according to sole, primary, and contributory causes see Britten, Collins, and Fitzgerald, op. cit., footnote 11, p. 448, and lines 21–26, p. 463.

In 90 percent of 16,488 reported periods of disability of 1 week or more in which a public accident was involved, the sole cause (or diagnosis) was the public accident, in 7 percent the public accident was the primary cause, and in only 3 percent, the contributory cause.

A small number of accident diagnoses (228) contributory to another accident diagnosis have been included for convenience in tabulating.

for 1 week or more was 6.6 per 1,000 persons [12] or 3.9 percent of all such cases of disability (from disease and accident) as reported in the National Health Survey.[13] Over 48 percent of public accidents (disabling for 1 week or more) involved a motor vehicle (whether the injured person was operating, riding in, or struck by a motor vehicle, including automobile, bus, truck, and motorcycle, but not streetcar or motorboat), the annual frequency rate being 3.17 per 1,000 for these accidents and 3.43 for public accidents exclusive of motor-vehicle accidents. Of the public accidents which did not involve automobiles, a large proportion were undoubtedly due to sports and recreations.

The severe nature of accidents occurring in public places is obvious from the fact that 55 percent of the cases of disability lasting 7 or more days had a duration of 1 month or longer.[14] The rate for cases disabling 1 month or more is 1.83 per 1,000 persons for public accidents involving motor vehicles and 1.77 for public accidents exclusive of motor-vehicle accidents.

Amount of disability from public accidents.—The annual number of days of disability due to public accidents (disabling for 1 week or more) was 0.33 per person in the observed population, or 44 percent of the total rate for accidents (0.75 days, all places of occurrence) and 3 percent of the total rate for all causes (9.9 days). Accidents involving motor vehicles, for which the annual days of disability per person in the observed population was 0.18, made up approximately 55 percent of the annual number of days of disability per person due to all public accidents combined.

The average duration (within the 12-month period) of public accidents disabling for 1 week or more was 51 days. For accidents involving motor vehicles the average duration (57 days) was 6 days longer than the average duration of all public accidents combined.[15]

Public accidents by sex.—The annual frequency rate of public accidents was over 46 percent higher for males than for females. As shown in table 1, the rate for males (all ages) was 7.90 per 1,000 persons and that for females, 5.40.

---

[12] Since the informant was asked at a single visit to recall accidents which had occurred in the family during the previous 12 months, this rate is somewhat below the true value, even though a minimum period of disability (7 consecutive days) was set in order to avoid too great underreporting.

[13] Forty-three percent of the accidents with known place of occurrence reported in the National Health Survey occurred in public places, 31 percent occurred in the home, and 26 percent were occupational. See Britten, Collins, and Fitzgerald, op. cit., p. 464.

[14] Particularly because of a certain amount of underreporting for the less severe accidents, the rate for public accidents disabling 1 month or more is somewhat more reliable than the rate for public accidents with a minimum period of disability of 7 days.

[15] Inclusion of public accidents disabling for less than 1 week would have slightly increased the days per person and greatly decreased the average duration of disability. Based on unpublished data from the survey made by the Committee on the Costs of Medical Care, which shows 0.73 days of disability from all causes (illnesses and accidents) per person per year for cases disabling less than 7 consecutive days, it is estimated that for public accidents the annual number of days of disability per person observed would be about 0.35 if cases disabling less than 1 week could have been included.

For that portion of public accidents involving a motor vehicle the rate for males (3.92 per 1,000 persons) was 57 percent higher than that for females (2.49), while for public accidents exclusive of motor-vehicle accidents the rate for males (3.98 per 1,000 persons) was 37 percent higher than that for females (2.91).

TABLE 1.—*Annual frequency of public accidents disabling for 1 week or more [a] by age and sex [b]*

Age (years)	Annual frequency per 1,000 persons			Ratio of the rate for males to that for females (rate for males=100)	Number of cases [c]		
	Both sexes	Male	Female		Both sexes	Male	Female
	Total public accidents						
All ages	6.60	7.90	5.40	146	16,487	9,477	7,010
Under 5	1.63	2.08	1.16	179	286	186	100
5–9	6.32	8.35	4.29	195	1,282	850	432
10–14	7.73	10.93	4.48	244	1,733	1,230	503
15–24	7.04	9.78	4.68	209	3,145	2,023	1,122
25–44	5.78	6.64	5.00	133	4,740	2,575	2,165
45–64	8.00	8.06	7.95	101	3,886	1,926	1,960
65 and over	9.94	10.79	9.24	117	1,415	687	728
	Public accidents involving motor vehicles						
All ages	3.17	3.92	2.49	157	7,929	4,701	3,228
Under 5	.82	1.12	.51	220	144	100	44
5–9	2.22	2.88	1.57	183	451	293	158
10–14	1.92	2.72	1.11	244	430	305	125
15–24	3.27	4.08	2.57	159	1,460	844	616
25–44	3.43	4.17	2.76	151	2,813	1,618	1,195
45–64	4.05	4.83	3.29	147	1,966	1,154	812
65 and over	4.67	6.08	3.53	172	665	387	278
	Public accidents exclusive of motor-vehicle accidents						
All ages	3.43	3.98	2.91	137	8,558	4,776	3,782
Under 5	.81	.96	.65	148	142	86	56
5–9	4.10	5.47	2.72	201	831	557	274
10–14	5.81	8.21	3.37	244	1,303	925	378
15–24	3.77	5.70	2.11	270	1,685	1,179	506
25–44	2.35	2.47	2.24	110	1,927	957	970
45–64	3.95	3.23	4.66	69	1,920	772	1,148
65 and over	5.27	4.71	5.71	82	750	300	450

That this excess in the public accident rate for males may not be attributable to a sex differential in accident proneness is suggested by the fact that the National Health Survey rate for home accidents was almost one-and-one-half times as high for females as for males.[16]

Because of the possibility of slightly more complete reporting by an informant of his or her own illness, the excesses in the rates for males may be somewhat of an understatement since in a greater percentage of instances females were the informants.

[16] See Britten, Rollo H., Klebba, Joan, and Hailman, David E.: Accidents in the urban home as recorded in the National Health Survey. Pub. Health Rep., 55: 2061 (1940).

Public accidents by age.—From infancy to age 15 years the annual frequency rate of public accidents increased, but the rate of increase from one age group to the next for this period varied widely. For children under 5 years the annual frequency rate was 1.63 per 1,000; for children 5–9 years, 6.32; and for children 10–14 years, 7.73. From age 15 to 45 years the annual frequency rate decreased, being 7.04 for the age group 15–24 years and 5.78 for the age group 25–44 years. After age 45 the rate increased with age from 8.00 for persons 45–64 years to 9.94 for persons 65 years and older.

As is also evident from table 1, for children under 5 years there was practically no difference between the number of public accidents (causing disability of 1 week or more) involving a motor vehicle and the number of public accidents exclusive of motor-vehicle accidents. From age 5 to 25 years, however, accidents not involving motor vehicles were of much greater frequency than motor-vehicle accidents, while from age 25 to 65 years motor-vehicle accidents were more frequent than other public accidents. After age 65 other public accidents were again more frequent than motor-vehicle accidents.

Amount of disability from public accidents by age.—The days of disability per person in the observed population for public accidents causing disability of 1 week or more rose steeply from 0.06 for children under 5 years of age to 0.24 for children 5–9 years, showed but little variation over the range 5–44 years, and then increased with advancing age to 0.75 for persons 65 years and older, as shown in table 2. Up until about age 15 motor-vehicle accidents caused fewer days of disability per person in the observed population than did other public accidents; over the range 15–64 years the reverse was true; and after age 65 the two rates were approximately equal.

TABLE 2.—*Annual days of disability per person observed and days of disability per case for public accidents disabling 1 week or more,[a] by age*

Age (years)	Annual days of disability per person observed[b]			Days of disability per case			Number of cases[d]
	Total	Public accidents involving motor vehicles	Public accidents exclusive of motor-vehicle accidents	Total	Public accidents involving motor vehicles	Public accidents exclusive of motor-vehicle accidents	
All ages	0.33	0.18	0.15	50.8	56.8	45.3	16,198
Under 5	.06	.03	.03	35.9	37.7	34.1	274
5–9	.24	.10	.14	37.3	43.9	33.7	1,265
10–14	.26	.08	.18	34.4	43.9	31.4	1,708
15–24	.29	.15	.14	42.1	48.1	36.9	3,076
25–44	.29	.18	.11	51.5	55.0	46.3	4,647
45–64	.48	.26	.22	60.1	64.5	55.7	3,828
65 and over	.75	.37	.38	76.9	80.8	73.6	1,400

The average length of periods of disability from public accidents increased steadily with age from 36 days for children under 5 years to 77 days for persons 65 years and older, with but one break in the

trend—for children 10–14 years of age the average length of periods of disability was 34 days, the lowest in the series. (See table 2.)

The average length of periods of disability from public accidents involving motor vehicles was higher at every age than that for public accidents exclusive of motor-vehicle accidents. Also, the average length of periods of disability for the former group of accidents in-

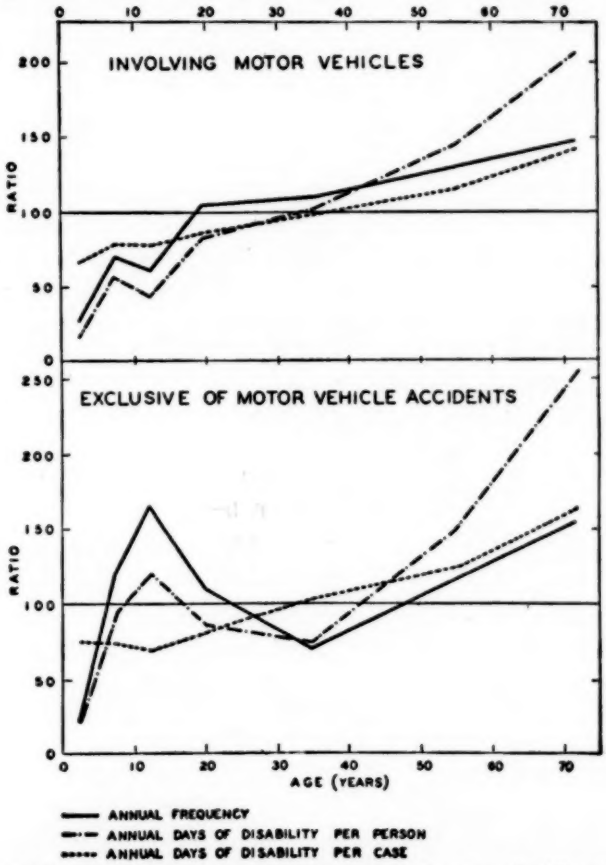

FIGURE 1.—Annual frequency and days of disability per person and per case of public accidents disabling for 1 week or more,[a] by age,[b] expressed as the ratio of the rate for each age group to that for all ages (rate for all ages=100).

creased steadily with age (except over the range 5–14 years, for which period it was constant) from 38 days for children under 5 years to 81 days for persons 65 years and older, while for the latter it decreased from 34 days for children under 5 years to 31 days for children 10–14 years, and then increased steadily with age to 74 days for persons 65 years and older.

As is evident in figure 1, in the case of motor-vehicle accidents disabling for 1 week or more the increase with age in annual days of disability per person in the observed population was due to an increase with age both in frequency and in average duration of disability.

The same relation obtained for public accidents exclusive of motor-vehicle accidents after about age 45 years, but not for the younger age groups. From infancy to about age 15 years the increase in the annual days of disability per person reflects solely the increased frequency of public accidents, since for this age group the annual frequency increased while the average length of periods of disability decreased. Similarly, for persons 15–44 years the decrease in the annual days of disability per person may be attributed to a decrease in the annual frequency, since for this group the annual frequency decreased while the average length of periods of disability increased.

Public accidents by age and sex.—As shown in table 1, at each age group the annual frequency rate of public accidents disabling for 1 week or more was higher for males than for females. The greatest excess in the rate for males over that for females occurred among children 10–14 years, the rate for males in this group being over 144 percent higher than that for females. Moreover, the excess in the rates for males was very much greater among persons under 25 years than for those over 25 years, as evidenced by the ratio of the rate for males to that for females, also shown in table 1.

For persons under 25 years of age the great excess in the rate for males over that for females was primarily due to public accidents other than those involving motor vehicles. This is evident from a comparison of figures 2 and 3.

In the case of public accidents involving motor vehicles the rate for males was higher than that for females for each age group, and the excesses in the rate for males over that for females were greater among persons under 15 and over 65 years than for persons 15–64 years. The highest rate for each sex (6.08 for males and 3.53 for females) occurred for persons 65 years and older. The greatest excess in the rate for males over that for females (144 percent) occurred for persons 10–14 years of age.

For public accidents exclusive of motor-vehicle accidents the situation was different in several respects. The rate for males was higher than that for females among persons under 45 years of age, but for persons over 45 years of age the rate for females was considerably higher than that for males (fig. 3). The highest rate for males (8.21 per 1,000 persons) was for persons 10–14 years of age, and for females (5.71), for persons 65 years and older. The greatest excess in the rate for males over that for females (170 percent) occurred for persons 15–24 years.

Public accidents and economic status.—Persons on relief [17] reported relatively more public accidents resulting in disability for 1 week or

[17] In the Health Survey, families were classified by income received during the 12 months preceding the interview and also by whether relief from official agencies had been received during that time. Persons in families with annual income under $1,000 comprised about 40 percent of the surveyed group, about 65 percent were in families with annual incomes under $1,500, and 80 percent in families with incomes under $2,000. Almost one-half of the lowest income group had been in receipt of relief during the year 1935.

more than did persons in the higher income brackets (table 3). Inclusion of motor-vehicle accidents to pedestrians probably accounts for much of the high rate among the relief group. The annual frequency rate of public accidents (all ages) decreased progressively from 7.73 for every 1,000 persons observed in the relief group to 6.10

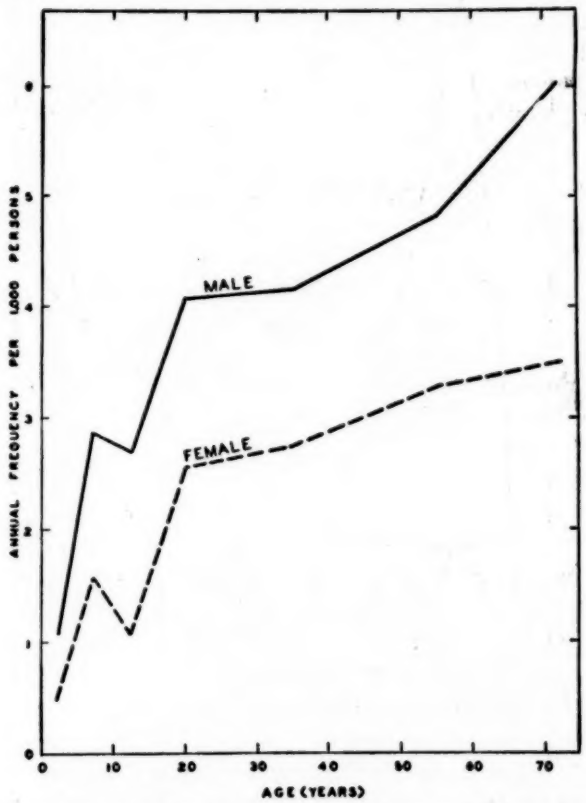

FIGURE 2.—Annual frequency (per 1,000 persons) of public accidents involving motor vehicles disabling for 1 week or more,[a] by age and sex.[b]

for the group with $1,500 to $2,000 annual family income and then rose to 6.56 for persons with annual family income of $2,000 and over. As is also evident from table 3, the pattern for all public accidents is repeated when the total is broken down into public accidents involving motor vehicles and public accidents exclusive of motor-vehicle accidents. The rate for the former (all ages) decreased progressively from 3.42 for every 1,000 persons in the relief group to 2.96 for the group with $1,500 to $2,000 annual family income and then increased to 3.19 for persons with $2,000 and more annual family income, while for the latter the rate (all ages) decreased progressively from 4.31 for persons in the relief group to 3.14 for the group with $1,500

to $2,000 annual family income and then increased to 3.37 for persons with annual family income of $2,000 and more.

Because of differences in the age composition of persons in the several income brackets and because the rate for serious public acci-

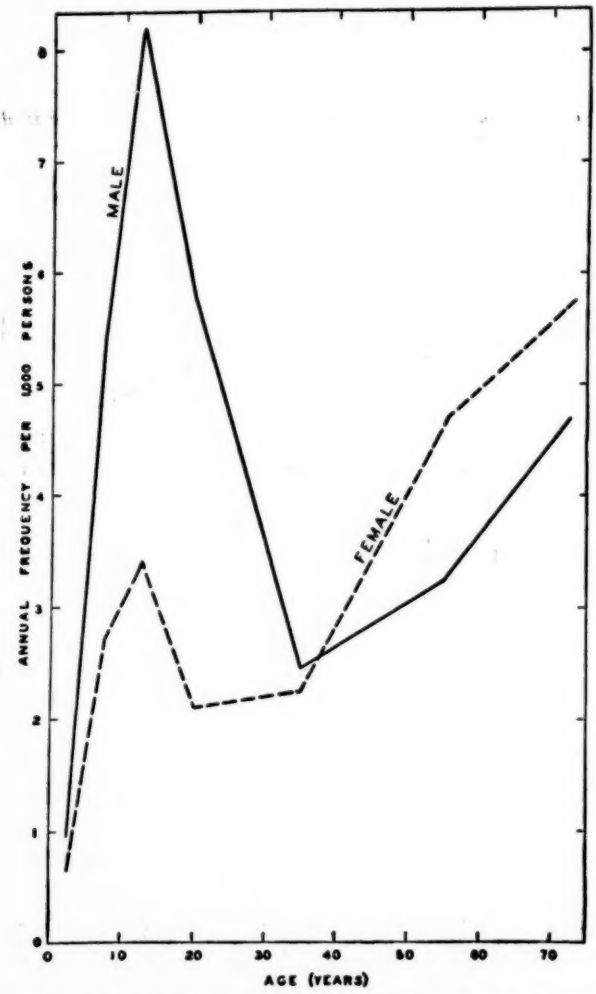

FIGURE 3.—Annual frequency (per 1,000 persons) of public accidents exclusive of motor-vehicle accidents disabling for 1 week or more,[a] by age and sex.[b]

dents increased with age, the actual (crude) rates for persons in families in each income group do not adequately describe the true relation between serious public accidents and economic status. Hence, the rates have been adjusted to a standard age distribution.[18]

[18] Within any income group the rate for public accidents disabling 1 week or more in each age group was multiplied by the total number of persons (all incomes) in that age group, the products were summed, and the sum was divided by the total number of persons. For standard population see figures given in *e* in references to tables and charts.

The resultant rates permit consideration of the relation between serious public accidents and economic status with the differential effect of one influencing factor—age—removed. The actual (or crude) and the adjusted rates as well as the rates by age for all public accidents and also for public accidents involving motor vehicles and for those not involving motor vehicles are shown in table 3 for different income groups.

TABLE 3.—*Annual frequency (per 1,000 persons) of public accidents disabling for 1 week or more,[a] by age and economic status*

Annual family income and relief status	Age (years)										Number of cases, all ages
	All ages			Under 5	5-9	10-14	15-24	25-44	45-64	65 and over	
	Crude	Adjusted[1] (a)	Adjusted[1] (b)								
	Total public accidents										
All incomes	6.60	6.60	6.60	1.63	6.32	7.73	7.04	5.78	8.00	9.94	[c] 16,487
Relief	7.73	8.01	7.80	2.22	6.72	8.89	7.72	7.67	10.14	11.13	3,496
Nonrelief:											
Under $1,000	6.60	6.49	6.90	1.30	5.63	7.11	6.68	5.72	8.52	10.12	3,806
$1,000 to $1,500	6.16	6.26	6.11	1.48	6.57	7.72	6.77	5.13	7.35	10.61	3,313
$1,500 to $2,000	6.10	6.13	6.02	1.47	6.20	7.20	7.21	5.32	6.85	8.89	2,401
$2,000 and over	6.56	6.46	6.47	1.33	6.51	7.27	7.57	5.67	7.60	8.48	2,879
	Public accidents involving motor vehicles										
All incomes	3.17	3.17	3.17	0.82	2.22	1.92	3.27	3.43	4.05	4.67	7,929
Relief	3.42	3.67	3.48	1.14	2.54	2.38	3.37	4.15	4.78	4.75	1,547
Nonrelief:											
Under $1,000	3.36	3.30	3.39	.83	2.37	2.15	3.38	3.54	4.16	4.93	1,936
$1,000 to $1,500	2.99	3.02	2.98	.83	2.23	1.83	3.19	3.07	3.83	5.19	1,607
$1,500 to $2,000	2.96	2.93	2.97	.65	2.00	1.59	3.35	3.17	3.66	4.00	1,164
$2,000 and over	3.19	3.05	3.21	.43	1.69	1.38	3.31	3.45	3.96	4.54	1,398
	Public accidents exclusive of motor-vehicle accidents										
All incomes	3.43	3.43	3.43	0.81	4.10	5.81	3.77	2.35	3.95	5.27	8,558
Relief	4.31	4.34	4.32	1.08	4.18	6.51	4.35	3.52	5.36	6.38	1,949
Nonrelief:											
Under $1,000	3.24	3.19	3.51	.48	3.26	4.96	3.30	2.18	4.36	5.19	1,870
$1,000 to $1,500	3.17	3.24	3.13	.65	4.34	5.89	3.58	2.06	3.52	5.42	1,706
$1,500 to $2,000	3.14	3.20	3.05	.81	4.20	5.61	3.86	2.15	3.19	4.89	1,237
$2,000 and over	3.37	3.41	3.26	.90	4.82	5.89	4.26	2.22	3.64	3.94	1,481

[1] Adjusted to (a) age and (b) city size and geographic area composition of all persons enumerated in the National Health Survey.

At each age the frequency of all public accidents disabling 1 week or more was greater for the relief group than for any other economic status group. But, as is evident from figure 4, the variation by economic status among persons of a particular age group was considerably different for public accidents involving motor vehicles from that for public accidents exclusive of motor-vehicle accidents. In the case of the former, among persons in the three youngest age groups

(under 5 years, 5–9 years, and 10–14 years), the rate decreased progressively with a rise in annual family income. For persons 15–24 years and for persons 65 years and older the differences in the rates

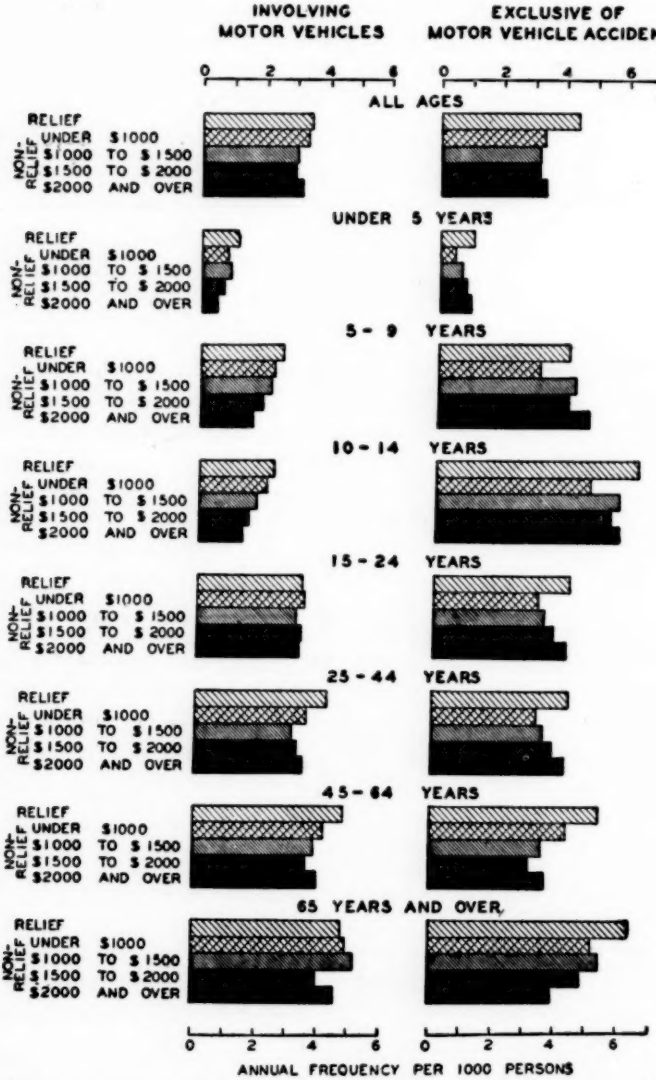

FIGURE 4.—Annual frequency (per 1,000 persons) of public accidents, disabling for 1 week or more • for each income group, by age.•

by economic status were not significant.[19] For the age groups 25–44 years and 45–64 years the greatest variation by economic status was the decrease in the rate for the relief group as compared with that for the nonrelief group with under $1,000 annual income (a decrease from 4.15 to 3.54 for persons 25–44 years, and 4.78 to 4.16 for persons

[19] Based on the use of the Chi square test, using a 0.05 level of significance.

45–64 years). Also, for both of these age groups the rate for the highest income group was greater than that for the two preceding income groups.

In the case of public accidents exclusive of motor-vehicle accidents (see fig. 4), in every age group except 5–9 years the rate for persons on relief was higher than that in any other economic status group. Among persons in the age groups under 25 years, the rate in general increased from the lowest rate for the group with under $1,000 annual family income to a rate for the highest income group which was almost as great as that for the relief group. Among persons 25–44 years the rate for the relief group was about 60 percent higher than the rate for any other economic status group, but there was no significant difference (see footnote 19) in the rates for the nonrelief economic status groups. For persons over 45 years the general trend was a decrease in the rate with increase in annual family income.

The annual frequency rates of public accidents were also adjusted [20] to investigate the possibility that elimination of the effect of size of city and location would result in a more accurate description of the relation between public accident rates and economic status (table 3). The adjusted rates decrease more pronouncedly than the crude rates with an increase in annual family income from the rate for the relief group to that for the group receiving from $1,500 to $2,000 annual family income. For the group with highest economic status ($2,000 and over) the increase over the rate for the previous economic status group is practically the same for the adjusted and crude rates. For public accidents involving motor vehicles (table 1) among persons on relief the adjusted rate is somewhat higher than the crude rate.

In figure 5 it is shown, by area and city size, that for persons under 15 years of age and persons 15–64 years the frequency rate of public accidents was higher for the relief group than for the nonrelief group. Of special significance in the case of public accidents involving motor vehicles is the excess of the rate for the relief group for persons under 15 years of age. Among persons 15–64 years, also, the rate for public accidents involving motor vehicles was higher among persons on relief than among those not on relief for each area and city size (except in the case of the rate for cities of 25,000 to 100,000 in the West, based on one city only).

In the case of public accidents exclusive of motor-vehicle accidents among persons 15–64 years, the rate for persons on relief was higher than for persons not on relief for each area and city size. Among

[20] Adjusted to city size and geographic area composition of all persons enumerated in the National Health Survey. (See *f* in references to tables and charts.)

persons under 15 years the rate for persons on relief was higher in cities of more than 25,000 population in all areas, but was lower for the Northeast and North Central cities of less than 25,000 population.

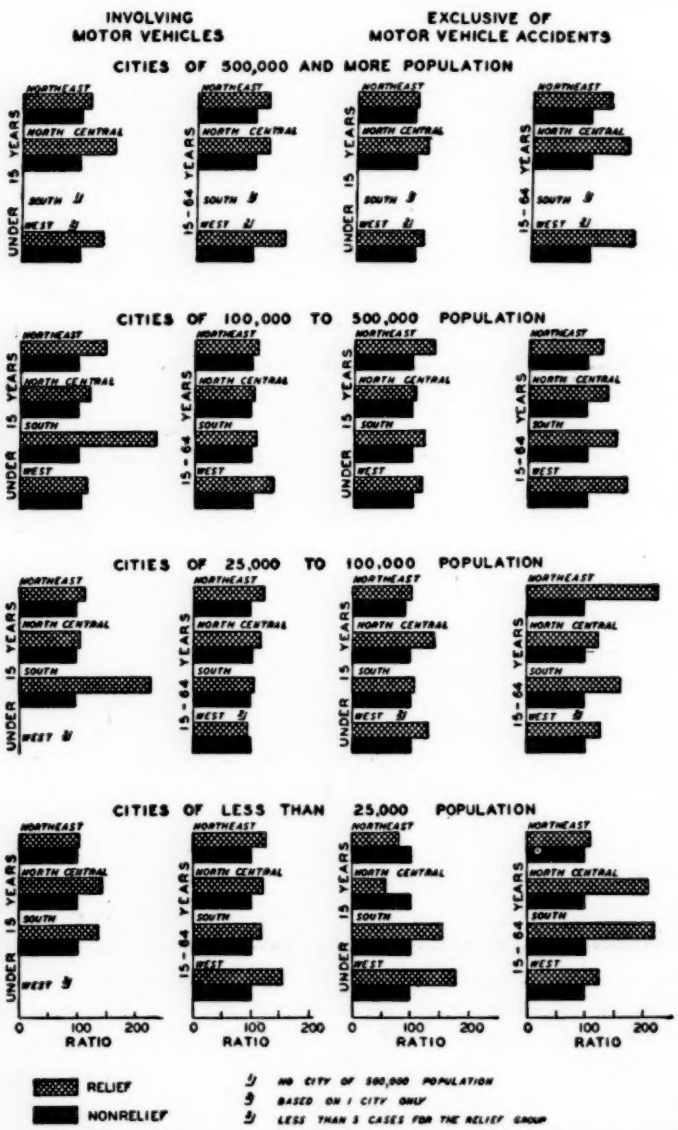

FIGURE 5.—Ratio of the annual frequency rate of public accidents disabling for 1 week or more * for the relief group to the rate for the nonrelief group by geographic area, size of city, and specified age groups (nonrelief group=100).

Public accidents by means of injury.—The means of injury for public accidents have been grouped into the following six broad categories: Motor vehicles, transportation facilities (nonmotor vehicle), falls, cutting and piercing instruments, animals (including venomous), and

all other means.[21] The annual frequency per 1,000 persons of public accidents disabling for 1 week or more, according to such categories, was:

Motor vehicles	3.17
Transportation facilities (nonmotor vehicle)	.19
Falls [1]	2.63
Cutting and piercing instruments	.17
Animals (including venomous)	.066
All other means [2]	.37

[1] The annual frequency rates for the accidental traumatisms included in falls were as follows: Fall with fracture, 1.09 per 1,000 persons; fall with infected wound, 0.05; other falls, 1.02; sprain (unspecified as to means of injury), 0.12; fracture (unspecified as to means of injury), 0.34.

[2] In the "all other" group, the largest annual frequency rates were for firearms and fireworks and burns, being, respectively, 0.047 and 0.026 per 1,000 persons.

Motor vehicles caused over 48 percent of public accidents (disabling 1 week or more); other transportation facilities, 3 percent; falls, 40 percent; cutting and piercing instruments, 3 percent; animals (including venomous), 1 percent; and all other means, less than 6 percent.

The annual frequency rates per 1,000 persons according to means of injury, classified by age and sex, are shown in table 4.

TABLE 4.—*Annual frequency (per 1,000 persons) of public accidents disabling for 1 week or more,[a] by means of injury and by sex and age of persons observed [b]*

[Rates in *italics* based on less than 5 cases]

Sex and means of injury	Age (years)								Number of cases, all ages
	All ages	Under 5	5–9	10–14	15–24	25–44	45–64	65 and over	
Both sexes, all means	6.60	1.63	6.32	7.73	7.04	5.78	8.00	9.94	[c] 16,487
Motor vehicles	3.17	.82	2.22	1.91	3.27	3.43	4.05	4.67	7,929
Transportation facilities (nonmotor vehicle)	.19	.057	.24	.41	.24	.14	.14	.21	472
Falls	2.63	.57	3.00	4.16	2.59	1.77	3.38	4.70	6,561
Cutting and piercing instruments	.17	.063	.34	.44	.22	.13	.072	.10	428
Animals (including venomous)	.066	.051	.099	.15	.059	.050	.057	.049	164
All other means [1]	.37	.068	.42	.66	.67	.26	.30	.20	933
Male, all means	7.90	2.08	8.35	10.93	9.78	6.64	8.06	10.79	9,477
Motor vehicles	3.92	1.12	2.88	2.71	4.08	4.17	4.83	6.08	4,701
Transportation facilities (nonmotor vehicle)	.21	.078	.30	.55	.31	.13	.12	.13	254
Falls	2.87	.68	3.90	5.72	3.88	1.72	2.56	4.10	3,446
Cutting and piercing instruments	.27	.089	.50	.68	.36	.20	.11	.094	319
Animals (including venomous)	.078	*.055*	.13	.21	.058	.059	.059	*.079*	94
All other means	.55	.078	.63	1.04	1.09	.36	.38	.32	663
Female, all means	5.40	1.16	4.29	4.48	4.68	5.00	7.95	9.24	7,010
Motor vehicles	2.49	.51	1.57	1.11	2.57	2.76	3.29	3.53	3,228
Transportation facilities (nonmotor vehicle)	.17	*.035*	.18	.26	.18	.14	.17	.28	218
Falls	2.40	.45	2.09	2.56	1.48	1.81	4.19	5.18	3,115
Cutting and piercing instruments	.085	*.055*	.17	.19	.096	.062	.036	.11	109
Animals (including venomous)	.054	.070	.069	.080	.058	.042	.057	*.025*	70
All other means	.21	.059	.21	.29	.29	.19	.21	.12	270

[1] The largest groups were firearms and fireworks with a rate of 0.047 per 1,000 (all ages) and burns, 0.026.

[a] "Falls" relates to falls of persons and includes fractures and sprains unspecified as to means of injury. "Cutting and piercing instruments" includes infected wounds unspecified as to means of injury. The "all other" group is made up largely of firearms and fireworks, burns, drownings, machinery, and of poisonings (gas, food, plants, etc.).

As is evident from figure 6, at every age the rates for falls and for motor-vehicle accidents were very much higher than the rates for any other means of injury. Among persons under 5 years of age the rate for falls was somewhat lower than the rate for motor-vehicle accidents; among persons 5–9 years of age the rate for falls was approximately one and one-third times as high as the rate for motor-vehicle accidents; and among persons 10–14 years of age the rate was over twice as high. After age 15, while the rate for motor-vehicle

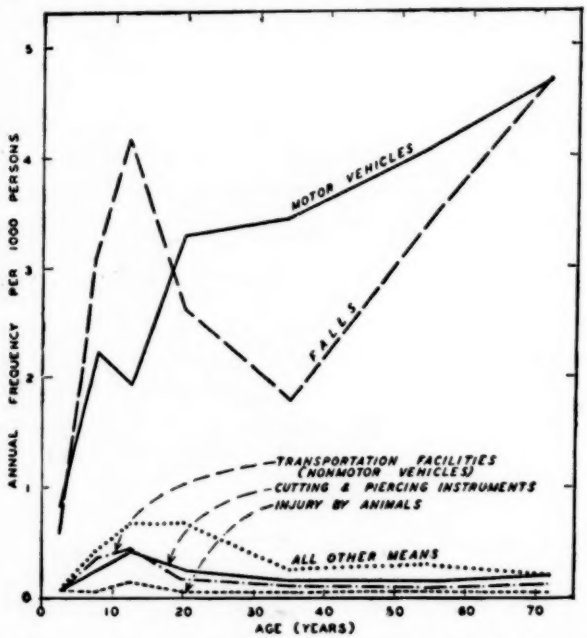

FIGURE 6.—Annual frequency (per 1,000 persons) of public accidents disabling for 1 week or more,[a] by age and means of injury.[b]

accidents increased steadily with age from 3.27 for persons 15–24 years to 4.67 for persons 65 years and over, the rate for falls decreased from 2.59 for persons 15–24 years to 1.77 for persons 25–44 years of age and then rose steeply to 4.70 for persons 65 years and older.

Although the rates for the other means of injury were very much smaller than those for falls, the variation with age was similar. For transportation facilities (other than motor vehicles), cutting and piercing instruments, and animals there was an increase in the rates from infancy to 15 years of age, a decrease from 15–64, and an increase for persons 65 years and over (except in the case of injury by animals for which the rate among persons 45–64 years was higher than that for the preceding or following age groups).

As is also shown in table 4, for each means of injury the rate among males was higher than that among females, the smallest excess in the

rate for males over that for females being for falls and the greatest (besides the "all other" group), for motor-vehicle accidents. Moreover, at every age for each means of injury the rate among males was higher than that among females except in the case of transportation facilities (nonmotor vehicle) and falls among persons 25 years and over and for cutting and piercing instruments among persons 65 years and over (considering only rates based on at least 5 cases).

Figure 7 gives the percentage distribution of public accidents disabling for 1 week or more by means of injury and age, showing again

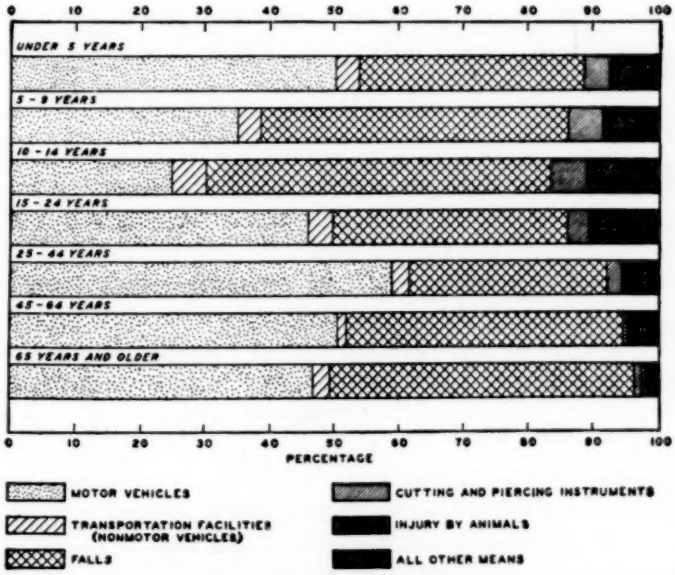

FIGURE 7.—Percentage distribution of public accidents disabling for 1 week or more [a] by means of injury in different age groups.[b]

that for each age group the proportion of all public accidents due to motor vehicles and the proportion due to falls was very much higher than that due to any other means of injury. For persons under 5 years, motor vehicles were the means of injury in a higher percentage of cases than falls; for persons 5–14 years of age, falls were the means of injury in a higher percentage of cases than were motor vehicles; for persons 15–64 years of age, accidents involving motor vehicles were most frequent; and for persons 65 years and over the percentage of public accidents due to motor vehicles was approximately the same as the percentage due to falls (46.98 and 47.28 percent, respectively).

Although, in comparison with public accidents due to motor vehicles or falls, those involving transportation facilities (other than motor vehicle), cutting and piercing instruments, animals, and the "all other" group occurred very infrequently, there was, nevertheless, considerable variation with age in the proportion due to these various

means of injury. The proportion of all public accidents due to transportation facilities other than motor vehicles increased from 3.5 percent for persons under 5 years to 5.3 percent for persons 10–14 years, then decreased steadily to 1.8 percent for persons 45–64 years, and rose to 2.1 for persons 65 years and older. The variation with age in the proportion due to cutting and piercing instruments was similar to that for falls. The proportion increased from 3.9 percent for persons under 5 years to 5.7 for persons 10–14 years, then decreased steadily to 0.90 for persons 45–64 years, and rose to 1.1 for persons 65 years and older. For persons under 5 years of age the proportion of public accidents due to injury by animals (3.1 percent) was very much greater than for any other age group.

SUMMARY

This report, the second of a series on accidents, summarizes National Health Survey data on serious accidents occurring in public places among some 2,500,000 white and colored persons in over 700,000 families in 83 cities of the United States.[22]

Frequency and disability.—Among persons enumerated in the National Health Survey the annual frequency rate of accidents which disabled for 1 week or more (48 percent of which were motor-vehicle accidents) was 6.60 per 1,000 persons, or 3.9 percent of all cases of disability (from disease and accident) lasting 1 week or more as reported in the National Health Survey. The annual frequency rate of accidents occurring in public places which disabled persons for 1 month or more within the 12-month period was 3.60 per 1,000 persons, or 1.83 for public accidents involving motor vehicles and 1.77 for public accidents exclusive of motor-vehicle accidents.

The annual number of days of disability from accidents occurring in public places (disabling for 1 week or more) per person in the observed population was 0.33, 55 percent of which was due to accidents involving motor vehicles. The average duration of disability (within the 12-month period) from accidents occurring in public places was 51 days; from public accidents involving motor vehicles, 57 days; and from public accidents exclusive of motor-vehicle accidents, 45 days.

Sex and age.—The annual frequency rate of recorded public accidents was over 46 percent higher for males than for females, being 7.90 per 1,000 persons for the former and 5.40 for the latter. From infancy to 15 years of age the rate (both sexes) increased from 1.63 for

[22] The first report in the series on accidents was entitled, Accidents in the urban home as recorded in the National Health Survey, by Rollo H. Britten, Joan Klebba, and David E. Hailman. Pub. Health Rep., 55: 2061 (1940).

For data on accidents, all places of occurrence, based on 8 cities selected from the 83 covered in the National Health Survey, see, Accidents as a cause of disability, Preliminary Report, Sickness and Medical Care Series, Bulletin No. 3, prepared by Arch B. Clark of the National Health Survey staff.

children under 5 years to 7.73 for children 5–14 years, decreased to 5.78 for persons 25–44 years, and rose to 9.94 for persons 65 years and older. The excess in the rate for males over that for females was greater for public accidents involving motor vehicles (57 percent) than for public accidents exclusive of motor vehicles (37 percent). There was little difference in the number of public accidents involving motor vehicles and the number exclusive of motor vehicles for persons under 5 years, but the latter were more frequent among persons 5–24 years of age and persons 65 years and over, while the former were more frequent for persons 25–64 years of age. The annual number of days of disability per person observed (within the 12-month period) increased with advancing age, public accidents involving motor vehicles causing fewer days of disability than those exclusive of motor vehicles among persons under age 15 and more among persons 15–64 years of age. Also, the average length of periods of disability for accidents occurring in public places increased with age, and was higher at every age for public accidents involving motor vehicles than for those exclusive of motor vehicles. For public accidents exclusive of motor-vehicle accidents, however, the average length of periods of disability decreased from 34 days for children under 5 years to 31 days for children 10–14 years, and then increased steadily with age to 74 days for persons 65 years and older.

At each age group the annual frequency rate was higher for males than for females. For persons under 25 years of age the great excess in the rate for males over that for females was primarily due to public accidents exclusive of motor-vehicle accidents.

Economic status.—For each age group persons on relief reported relatively more public accidents resulting in disability of 1 week or more than did persons in the higher income brackets. For public accidents involving motor vehicles the rate decreased progressively with rise in annual family income among persons in the age groups under 15 years, did not vary significantly with increased income for persons 15–24 years or for persons 65 years and older, and decreased with an increase in annual family income up to $1,500 for persons 25–44 and up to $2,000 for persons 45–64 years. For public accidents exclusive of motor vehicles, the rate for persons on relief is higher than the rate for persons in any other economic status group except for persons 5–9 years of age. Among persons under 25 years the rate increased with rise in income from the low rate for the income group under $1,000 (nonrelief). Among persons 25–44 years the relief rate was very high but there was no significant variation in the rates for the nonrelief groups, and among persons over 45 years the general trend was a decrease with increase in annual family income. Also, the proportion of persons having public accidents was higher among

the relief group than among the nonrelief group for each area and city size.

Means of injury.—Motor vehicles were the means of injury in 48 percent of public accidents (disabling 1 week or more), falls in 40 percent, transportation facilities other than motor vehicles in 3 percent, cutting and piercing instruments in 3 percent, animals (including venomous) in 1 percent, and all other means in less than 6 percent. For each age group the rates for motor-vehicle accidents and for falls were very much higher than the rates for any other means. Until about age 15 the rate for falls was much higher than that for motor vehicles, after which age the reverse was true until after 65 years of age when the rate for falls was again slightly higher than that for motor vehicles. For transportation facilities (other than motor vehicles), cutting and piercing instruments, and animals, there was an increase in the rates from infancy to age 15, a decrease from age 15 to 65, and an increase with age for persons 65 years and over (except in the case of injury by animals for which the rate among persons 45–64 years was higher than that for the preceding or following age groups).

For each means of injury and at every age (except in the case of transportation facilities other than motor vehicle, falls among persons 25 years of age and over, and cutting and piercing instruments for persons 65 years and over) the rate for males was higher than that for females.

REFERENCES TO TABLES AND CHARTS

(These references are to be considered as supplementary to the basic description of the National Health Survey technique and definitions which have been given in "Scope and method of a Nation-wide canvass of sickness in relation to its social and economic setting," by George St. J. Perrott, Clark Tibbitts, and Rollo H. Britten. Pub. Health Rep., **54:** 1663 (1939). Reprint No. 2098.)

a Includes a small number of cases with disability of less than 7 days, but which had hospital care or resulted in death.

b Based on 2,498,180 persons of known age in 83 cities, distributed by age and sex as follows:

	All ages	Under 5 years	5–9 years	10–14 years	15–24 years	25–44 years	45–64 years	65 years and over
Both sexes	2,498,180	175,653	202,770	224,391	446,369	820,826	485,762	142,409
Male	1,200,728	89,214	101,917	112,076	206,696	388,002	239,187	63,636
Female	1,297,452	86,439	100,853	112,315	239,673	432,824	246,575	78,773

c Excludes 10 public accidents (of a total of 16,497) unknown as to age of persons observed.

d Excludes 299 public accidents (of a total of 16,497) unknown as to age of persons observed and/or duration of disability.

e Rate for all incomes (including unknown) based on 2,498,180 persons of known age in 83 cities, distributed by age and income as follows:

	Under 5 years	5–9 years	10–14 years	15–24 years	25–44 years	45–64 years	65 years and over
All incomes (including unknown)	175,653	202,770	224,391	446,369	820,826	485,762	142,409
Relief	46,431	53,059	57,126	83,038	119,426	71,497	22,087
Nonrelief:							
Under $1,000	39,943	42,974	47,388	102,079	183,679	114,840	45,815
$1,000 to $1,500	39,739	44,423	47,021	93,358	189,221	97,902	26,002
$1,500 to $2,000	24,558	29,538	33,332	68,418	142,100	77,954	18,001
$2,000 and over	21,086	27,814	33,291	77,147	155,518	100,659	23,347

Rates for persons of unknown income based on 277 cases among 98,369 persons are not shown.

f Based on 2,498,180 persons of known age distributed by area and size of city as shown in "The relief and income status of the urban population of the United States, 1935," National Health Survey, Preliminary Reports, Bulletin C, table 5, page 9.

THE ORAL TRANSMISSION OF *PLASMODIUM RELICTUM* IN THE PIGEON

By MARTIN D. YOUNG, *Associate Zoologist, Malaria Investigations, United States Public Health Service*

Any new approach to the problem of transmission of malaria is of vital importance and might throw light on the development of the parasite between its entrance into the body and its appearance in the blood stream. Recently, Shortt and Menon (*1*) have reported the oral transmission of *Plasmodium knowlesi* in monkeys and *P. gallinaceum* in chickens. The far-reaching implications of this work indicates the necessity of confirming the experiments and of determining how many species of malaria can be transmitted by this route.

In the present experiments the malaria parasite of pigeons, *P. relictum*, was used. Blood was drawn from the donors by heart puncture and citrated. At the time of administration, most of the parasites were mature segmenters or had just segmented. In the oral administrations the blood was put into the crop by the use of a ureter catheter attached to a syringe. The control birds received blood by heart puncture. The data on these infections are tabulated in table 1.

In the first transfer, orally inoculated pigeons 421 and 422 developed the infection, as well as the control pigeon 420C. Infected blood from orally inoculated pigeon 421 was given to pigeon 425C by heart puncture. The resulting infection indicated that the parasites were viable.

TABLE 1.—*Data on oral and heart puncture inoculations of pigeons with Plasmodium relictum*

Pigeon	Infected blood			Resulting infection		Remarks
	Source	Amount given	Route	Prepatent period, days	Intensity	
420C	414	3 cc.	Heart	3	Heavy	Died of infection.
421	414	8 cc.	Oral	7	Low	
422	414	8 cc.	do	13	Heavy	Do.
425C	421	8 cc.	Heart	4	do	Killed.
429	425C	8 cc.	Oral	16	Low	
506	425C	1 cc.	do	6	do	
502	422	1 cc.	do	21	Heavy	Second oral transfer.
504	422	4 cc.	do	23	Low	Do.
505	422	4 cc.	do	11	Heavy	Do.

For the second consecutive oral transfer, pigeon 422 was used as the donor. Pigeons 502, 504, and 505 received the infected blood orally and developed infections. The amount of blood given was smaller than in the first transfer; even 1 cc. produced a heavy infection (pigeon 502).

So far, 10 pigeons have received infected blood by the oral route, and 7 of these have developed infections. The malaria has been transferred through two consecutive passages by oral administration.

Although the possibility of the entrance of the parasites directly into the blood stream through an abrasion in the mucosa of the crop cannot be excluded, such an entrance is not considered probable in these experiments. Eliminating this possibility, the development of the malarial infection after oral administration indicates that the parasites enter the body tissues through the alimentary tract, either by the activity of the parasites or by the activity of the tissue cells. This adds further evidence to that recently obtained on the exo-erythrocytic forms of malaria, indicating that these parasites may be able to live in types of tissue other than blood.

REFERENCE

(1) Shortt, H. E., and Menon, K. P.: Experimental production of monkey and avian malaria by an unusual route of infection. J. Malaria Institute of India, **3:** 195–198 (1940).

COURT DECISION ON PUBLIC HEALTH

Amendment to restaurant licensing law held void.—(Wisconsin Supreme Court; *State ex rel. F. W. Woolworth Co.* v. *State Board of Health et al.*, 298 N.W. 183; decided May 20, 1941.) (Chapter 440 of the Wisconsin Laws of 1935 added to the Wisconsin statute relating to the licensing of restaurants a subsection which provided that no permit should be issued to operate or maintain any restaurant where

there was conducted any other business, except the sale of fermented malt and nonintoxicating beverages, intoxicating liquors, chewing gum, candies and other confections, or newspapers, unless such restaurant and the kitchens or other places used in connection therewith were completely and effectively separated from such other business in the same room or place by substantial partitions extending from the floor to the ceiling with self-closing doors for ingress and egress. The provisions of this subsection were applicable only to restaurants commencing business after the effective date of the subsection.

In a mandamus proceeding in which it was sought to compel the State board of health to grant a permit to conduct a restaurant, it was contended by the relator that the added subsection was void under the Federal and State constitutions as denying to it due process and equality before the law. The supreme court took the view that the contention of the relator had to be sustained and said that, the amendment being void, the existing statute remained in force. The basis for licensing the business involved, said the court, was that it was required for the protection of the public health and safety. "If protection of the public health and safety requires partitions in case of a business subsequently to be commenced, then by the same token it requires them in case of existing businesses; and if one operating an existing restaurant is not required to maintain the partition, and one about to establish a restaurant is required to maintain one, then manifestly the latter is denied equal protection with the former."

DEATHS DURING WEEK ENDED JUNE 28, 1941

[From the Weekly Mortality Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended June 28, 1941	Corresponding week, 1940
Data from 87 large cities of the United States:		
Total deaths	8,585	7,505
Average for 3 prior years	7,469	
Total deaths, first 26 weeks of year	230,242	230,629
Deaths per 1,000 population, first 26 weeks of year, annual rate	12.4	12.4
Deaths under 1 year of age	547	492
Average for 3 prior years	514	
Deaths under 1 year of age, first 26 weeks of year	13,625	13,185
Data from industrial insurance companies:		
Policies in force	64,419,021	65,146,174
Number of death claims	11,150	11,776
Death claims per 1,000 policies in force, annual rate	9.0	9.5
Death claims per 1,000 policies, first 26 weeks of year, annual rate	10.1	10.3

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED JULY 5, 1941

Summary

A total of 82 cases of poliomyelitis was reported for the current week, as compared with 79 cases for the preceding week, and with a 5-year (1936–40) median of 71. As compared with the preceding week, the number of cases in Georgia decreased from 23 to 19, in Florida from 10 to 6, and in California from 7 to 3, while increases were recorded for Alabama, from 10 to 22, Illinois, from 0 to 5, Pennsylvania, from 1 to 4, and Texas, from 2 to 4. The total number of cases reported to date (first 27 weeks) for the country as a whole is 796 as compared with 847 cases in 1940, which was also the median number of cases reported for the corresponding period of the past 5 years. For this period, 1,071 cases were reported in 1937 and 868 in 1939.

The highest incidence rates so far this year have been reported in the South Atlantic States, where Florida and Georgia have reported 166 of the 236 cases; in the Pacific States, where California has reported 70 of the 90 cases; in the Mountain States, where Montana has reported 10 of the 32 cases; and in the East South Central area (Mississippi, 31; Alabama, 46; Kentucky, 23; and Tennessee, 12).

A total of 8,339 cases of measles was reported, as compared with 12,699 for the preceding week. Of 47 cases of endemic typhus fever, 24 cases were reported in Georgia and 14 in Texas; and of 16 cases of Rocky Mountain spotted fever, 8 were reported in the Mountain States and 8 in the eastern and central States.

The death rate for the current week in 88 major cities of the United States is 10.9 per 1,000 population, as compared with 12.0 for the preceding week, and with a 3-year average of 10.1. The cumulative rate for these cities to date (first 27 weeks) this year is 12.3, the same as for the corresponding period of last year.

Telegraphic morbidity reports from State health officers for the week ended July 5, 1941, and comparison with corresponding week of 1940 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported, cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended		Median 1936–40	Week ended		Median 1936–40	Week ended		Median 1936–40	Week ended		Median 1936–40
	July 5, 1941	July 6, 1940		July 5, 1941	July 6, 1940		July 5, 1941	July 6, 1940		July 5, 1941	July 6, 1940	
NEW ENG.												
Maine	0	1	0	----	----	----	59	147	21	0	0	0
New Hampshire	0	0	0	----	----	----	0	0	9	0	0	0
Vermont	0	0	0	----	----	----	61	19	30	0	0	0
Massachusetts	0	0	1	----	----	----	553	824	361	0	0	1
Rhode Island	0	0	0	----	----	----	1	53	20	0	0	0
Connecticut	0	1	1	2	----	1	240	15	43	0	0	0
MID. ATL.												
New York	8	10	21	[3]	[4]	[1]	985	573	738	4	3	4
New Jersey	1	2	6	----	1	1	360	258	258	0	0	0
Pennsylvania [2]	6	9	18	----	----	----	1,294	272	616	2	2	5
E. NO. CEN.												
Ohio	3	6	8	5	16	5	651	40	197	1	2	2
Indiana	4	2	6	2	2	4	99	4	15	0	0	0
Illinois	7	8	25	1	5	4	236	150	150	1	1	1
Michigan [2]	0	1	6	1	----	----	406	230	230	0	0	1
Wisconsin	0	0	1	9	5	8	735	643	216	0	0	0
W. NO. CEN.												
Minnesota	1	0	1	1	2	----	11	27	31	0	0	0
Iowa [2]	1	2	2	----	1	----	69	156	101	0	0	0
Missouri [2]	1	0	3	2	----	6	150	18	16	0	0	0
North Dakota	0	0	0	13	----	----	12	3	3	1	0	1
South Dakota	10	4	1	----	----	----	5	3	3	0	0	0
Nebraska	0	1	1	----	----	----	16	7	7	0	1	1
Kansas	5	3	3	15	2	----	60	99	12	1	0	0
SO. ATL.												
Delaware	0	0	0	----	----	----	14	1	2	0	0	0
Maryland [2 3]	5	0	3	----	2	1	314	10	17	6	1	0
Dist. of Col	1	1	2	----	----	----	60	2	34	1	0	0
Virginia [2]	4	2	6	69	25	----	311	56	89	1	0	2
West Virginia [2]	4	2	3	4	2	3	181	9	15	1	0	0
North Carolina [4]	3	1	5	----	2	1	237	35	37	0	0	2
South Carolina	1	6	4	74	93	90	192	8	14	1	0	1
Georgia [4]	9	3	7	5	13	----	102	43	----	0	0	0
Florida [4]	1	0	1	10	----	----	12	9	9	1	0	1
E. SO. CEN.												
Kentucky	0	1	3	----	1	1	44	56	45	1	2	3
Tennessee [2]	1	3	4	11	12	12	84	27	41	0	2	3
Alabama [4]	2	1	6	----	3	3	27	133	39	1	0	0
Mississippi [2 4]	7	3	4	----	----	----	----	----	----	0	0	1
W. SO. CEN.												
Arkansas	2	0	3	6	4	6	71	12	10	0	0	0
Louisiana [4]	1	1	6	1	9	9	3	3	5	1	1	0
Oklahoma	3	4	4	11	10	10	74	12	12	0	3	1
Texas [4]	18	8	14	264	61	61	196	171	99	1	1	0
MOUNTAIN												
Montana [2]	3	1	0	----	----	----	7	31	8	0	0	0
Idaho	1	0	0	----	1	----	7	4	3	0	0	0
Wyoming [2]	0	1	1	----	----	----	6	14	3	1	0	0
Colorado [2]	4	15	8	12	1	----	54	16	16	0	0	0
New Mexico	2	2	2	1	----	----	48	32	14	0	0	0
Arizona	0	0	1	35	18	18	77	36	17	0	0	0
Utah [2]	1	0	1	2	----	----	9	79	46	0	0	0
Nevada [2]	0	----	----	----	----	----	3	----	----	0	----	----
PACIFIC												
Washington	3	2	2	----	----	----	15	63	63	0	0	0
Oregon	1	3	1	9	----	4	21	48	14	0	0	0
California	5	16	22	30	17	11	167	136	394	2	2	2
Total	129	126	287	598	312	312	8,339	4,587	4,587	28	21	32
27 weeks	6,720	7,898	11,937	595,961	166,984	149,771	809,463	212,527	259,498	1,237	1,004	1,926

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended July 5, 1941, and comparison with corresponding week of 1940 and 5-year median—Continued

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended—		Median 1936–40	Week ended—		Median 1936–40	Week ended—		Median 1936–40	Week ended—		Median 1936–40
	July 5, 1941	July 6, 1940		July 5, 1941	July 6, 1940		July 5, 1941	July 6, 1940		July 5, 1941	July 6, 1940	
NEW ENG.												
Maine	0	0	0	3	2	4	0	0	0	2	1	1
New Hampshire	0	0	0	0	0	1	0	0	0	0	0	0
Vermont	0	0	0	0	0	2	0	0	0	0	0	0
Massachusetts	[6] 0	1	1	65	54	73	0	0	0	3	2	2
Rhode Island	0	1	0	2	4	6	0	0	0	0	0	0
Connecticut	0	0	0	12	20	20	0	0	0	0	0	0
MID. ATL.												
New York	3	1	3	140	170	170	0	0	0	5	6	6
New Jersey	1	0	1	32	65	51	0	0	0	2	2	3
Pennsylvania [2]	4	2	0	76	100	128	0	0	0	7	13	13
E. NO. CEN.												
Ohio	1	3	1	113	105	98	0	0	1	7	8	9
Indiana	0	2	1	13	7	27	0	1	3	2	1	5
Illinois	5	1	2	65	133	133	4	4	4	14	4	6
Michigan [3]	0	1	1	98	67	135	2	0	0	6	2	2
Wisconsin	0	1	1	34	50	57	2	2	2	0	1	1
W. NO. CEN.												
Minnesota	2	1	0	15	32	32	2	1	5	0	0	0
Iowa [2]	0	1	0	9	15	18	0	9	16	3	3	2
Missouri [2]	0	0	1	0	12	19	0	0	6	7	5	6
North Dakota	0	0	0	4	4	4	0	0	3	0	1	0
South Dakota	0	0	0	4	2	6	0	4	4	0	0	0
Nebraska	0	1	0	7	8	8	0	0	1	0	0	0
Kansas	0	4	0	15	21	25	0	1	0	3	3	4
SO. ATL.												
Delaware	0	0	0	4	1	2	0	0	0	0	2	0
Maryland [2 3]	0	0	0	27	11	12	0	0	0	6	2	2
Dist. of Col	0	0	0	3	11	5	0	0	0	0	0	0
Virginia [3]	0	2	1	5	8	11	0	0	0	3	12	16
West Virginia [3]	0	2	0	13	10	11	0	1	1	2	5	5
North Carolina [4]	1	1	1	9	18	15	0	0	0	9	4	11
South Carolina	3	0	0	1	1	2	0	0	0	5	14	21
Georgia [4]	19	0	3	3	9	8	0	0	0	20	21	25
Florida [4]	6	1	1	1	1	1	0	0	0	2	4	1
E. SO. CEN.												
Kentucky	2	2	1	25	8	12	0	0	0	13	7	23
Tennessee [3]	0	0	1	14	11	13	1	1	0	10	3	24
Alabama [4]	22	1	4	5	14	9	0	2	2	5	5	10
Mississippi [3]	6	2	2	2	2	4	0	0	0	11	8	13
W. SO. CEN.												
Arkansas	0	0	0	0	3	2	0	0	0	8	8	16
Louisiana [4]	0	0	0	1	4	4	0	0	0	9	12	20
Oklahoma	0	8	3	9	9	9	3	1	1	9	13	13
Texas [4]	4	1	1	25	20	20	1	2	2	48	30	43
MOUNTAIN												
Montana [3]	0	1	0	10	12	12	0	0	18	1	0	1
Idaho	0	1	0	1	5	2	0	0	2	0	0	0
Wyoming [3]	0	0	0	0	5	5	0	0	0	1	0	0
Colorado [3]	0	0	0	8	2	11	0	1	1	2	0	2
New Mexico	0	0	0	1	1	3	0	0	0	5	3	3
Arizona	0	0	1	1	2	2	2	0	0	1	0	3
Utah [3]	0	0	0	0	6	9	0	0	0	0	0	1
Nevada [3]	0	----	----	0	----	----	0	----	----	0	----	----
PACIFIC												
Washington	0	15	0	7	19	14	0	1	2	0	4	4
Oregon	0	0	0	5	9	7	3	0	2	0	1	1
California	3	14	8	35	57	63	0	0	3	6	5	5
Total	82	71	71	922	1,130	1,283	20	31	107	237	215	361
27 weeks	[5] 796	847	847	87,779	114,067	131,647	1,133	1,794	7,466	2,691	2,861	4,164

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended July 5, 1941, and comparison with corresponding week of 1940—Continued

Division and State	Whooping cough	
	Week ended—	
	July 5, 1941	July 6, 1940
NEW ENG.		
Maine	25	22
New Hampshire	1	0
Vermont	0	14
Massachusetts	101	84
Rhode Island	18	8
Connecticut	42	26
MID. ATL.		
New York	226	245
New Jersey	53	52
Pennsylvania [2]	314	238
E. NO. CEN.		
Ohio	346	243
Indiana	9	17
Illinois	75	88
Michigan [3]	223	146
Wisconsin	103	88
W. NO. CEN.		
Minnesota	63	39
Iowa [2]	47	63
Missouri [2]	0	36
North Dakota	28	6
South Dakota	7	4
Nebraska	17	9
Kansas	149	50
SO. ATL.		
Delaware	2	4
Maryland [2 3]	84	128
Dist. of Col.	9	3
Virginia [2]	112	69
West Virginia [3]	57	46
North Carolina [4]	185	123
South Carolina	91	22
Georgia [4]	15	37
Florida [4]	8	10
E. SO. CEN.		
Kentucky	45	61
Tennessee [3]	43	62
Alabama [4]	14	16
Mississippi [3 4]	----	----
W. SO. CEN.		
Arkansas	22	37
Louisiana [4]	12	4
Oklahoma	25	17
Texas [4]	274	234
MOUNTAIN		
Montana [2]	14	6
Idaho	10	7
Wyoming [2]	0	17
Colorado [2]	98	9
New Mexico	42	22
Arizona	31	3
Utah [3]	28	103
Nevada [3]	12	----
PACIFIC		
Washington	52	29
Oregon	26	16
California	318	287
Total	3,476	2,850
27 weeks	123,174	86,536

[1] New York City only.
[2] Rocky Mountain spotted fever, week ended July 5, 1941, 16 cases, as follows: Pennsylvania, 1; Iowa, 1; Missouri, 1; Maryland, 2; Virginia, 1; Tennessee, 2; Montana, 1; Wyoming, 4; Colorado, 2; Nevada, 1.
[3] Period ended earlier than Saturday.
[4] Typhus fever, week ended July 5, 1941, 47 cases, as follows: North Carolina, 2; Georgia, 24; Florida, 1; Alabama, 4; Mississippi, 1; Louisiana, 1; Texas, 14.
[5] Information has been received that the report of 1 case of poliomyelitis in Massachusetts for the week ended Apr. 12, 1941, Public Health Reports of Apr. 18, p. 862, was an error, no case having occurred.

PLAGUE INFECTION IN CALIFORNIA

Under the respective dates of June 24 and 27, 1941, Dr. N. E. Wayson, Medical Officer in Charge, Plague Suppressive Measures, San Francisco, Calif., reported plague infection proved as follows:

IN FLEAS FROM RATS IN CONTRA COSTA COUNTY

In a pool of 5 fleas from 68 rats, *R. norvegicus*, submitted to the laboratory on June 3 from a garbage dump approximately 2 miles northwest of City Hall, Richmond, Contra Costa County, Calif.

IN A RAT IN SAN FRANCISCO

In a rat, *R. norvegicus*, trapped on May 28, at 1740 Kirkwood Avenue, San Francisco, Calif.

Dr. Bertram P. Brown, State Director of Public Health of California, in reports forwarded under date of June 26, reported plague infection proved in fleas as follows:

IN FLEAS FROM SQUIRREL BURROWS IN KERN COUNTY

In a pool of 161 fleas submitted to the laboratory on June 10 from squirrel burrows on a ranch 2 miles south of Davis Ranger Station, Kern County, Calif.

IN FLEAS FROM GROUND SQUIRRELS IN KERN COUNTY

In a pool of 84 fleas from 5 ground squirrels, *C. beecheyi*, submitted on June 11 from a ranch 6 miles south of Davis Ranger Station, and in another pool of 201 fleas from ground squirrels of the same species submitted on June 6 from a ranch 3 miles south of Davis Ranger Station.

IN FLEAS FROM GROUND SQUIRRELS IN LOS ANGELES COUNTY

In a pool of 41 fleas from 4 ground squirrels, *C. beecheyi*, submitted to the laboratory on June 12 from Gorman Dump, one-half mile east of Gorman, Los Angeles County, Calif.

WEEKLY REPORTS FROM CITIES

City reports for week ended June 21, 1941

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	101	31	16	2,734	313	884	10	355	35	1,218	----
Current week [1]	49	24	16	3,373	212	833	2	316	20	1,256	----
Maine:											
Portland	0	1	0	1	2	0	0	0	0	12	23
New Hampshire:											
Concord	----	----	----	----	----	----	----	----	----	----	----
Nashua	0	----	0	0	0	0	0	0	0	0	4
Vermont:											
Barre	----	----	----	----	----	----	----	----	----	----	----
Burlington	0	----	0	0	0	0	0	0	0	0	10
Rutland	0	----	0	0	0	0	0	0	0	0	1
Massachusetts:											
Boston	3	----	0	165	11	76	0	8	1	35	201
Fall River	1	----	0	4	0	5	0	0	0	2	32
Springfield	0	----	0	51	1	6	0	0	0	10	37
Worcester	0	----	0	12	1	7	0	0	0	4	38
Rhode Island:											
Pawtucket	1	----	0	0	0	0	0	0	0	1	21
Providence	0	----	0	1	2	2	0	1	0	18	46
Connecticut:											
Bridgeport	0	----	0	12	2	2	0	1	0	6	31
Hartford	0	----	0	5	0	1	0	0	0	0	23
New Haven	0	----	0	6	0	9	0	2	0	0	28
New York:											
Buffalo	0	----	0	44	3	31	0	5	0	9	108
New York	13	----	2	442	35	153	0	78	6	88	1,358
Rochester	0	----	0	116	1	2	0	0	0	12	60
Syracuse	0	----	0	19	2	8	0	0	1	34	39
New Jersey:											
Camden	0	----	0	4	2	7	0	1	0	1	44
Newark	0	----	0	39	3	7	0	5	0	16	80
Trenton	0	----	0	31	2	11	0	1	0	0	38
Pennsylvania:											
Philadelphia	2	1	1	77	7	86	0	15	1	50	414
Pittsburgh	0	----	0	396	6	20	0	11	1	40	149
Reading	0	----	0	23	0	2	0	1	0	0	23
Ohio:											
Cincinnati	3	----	0	9	3	7	0	8	0	7	107
Cleveland	0	2	0	6	4	28	0	9	0	68	163
Columbus	0	----	0	30	2	1	0	5	0	5	78
Toledo	0	----	0	330	1	3	0	3	0	23	78
Indiana:											
Anderson	0	----	0	13	0	0	0	0	0	0	4
Fort Wayne	0	----	0	2	2	2	0	2	0	0	32
Indianapolis	0	----	0	97	0	4	0	1	1	6	66
Muncie	0	----	0	9	1	2	0	0	0	0	12
South Bend	0	----	0	6	1	0	0	0	0	0	12
Terre Haute	0	----	0	1	0	0	0	0	0	0	19
Illinois:											
Alton	0	----	0	7	1	0	1	0	0	0	11
Chicago	11	----	0	68	15	96	0	21	1	51	642
Elgin	0	----	0	1	0	0	0	0	0	3	5
Moline	0	----	0	6	0	0	0	0	0	0	7
Springfield	0	----	0	45	1	0	0	0	0	0	26
Michigan:											
Detroit	1	----	0	216	11	90	0	15	1	67	259
Flint	0	----	0	12	0	1	0	0	0	11	31
Grand Rapids	0	----	0	48	0	12	0	0	0	2	35
Wisconsin:											
Kenosha	0	----	0	7	0	1	0	0	0	0	10
Madison	0	----	0	14	0	4	0	0	0	1	13
Milwaukee	1	1	1	403	4	17	0	4	0	44	96
Racine	0	----	0	26	0	0	0	2	0	6	11
Superior	0	----	0	1	0	1	0	0	0	4	14
Minnesota:											
Duluth	0	----	0	1	0	0	0	0	0	25	19
Minneapolis	0	----	0	9	2	7	0	2	1	7	98
St. Paul	0	----	0	1	1	3	0	2	0	28	70

[1] Figures for Concord, Barre, Tampa, and Spokane estimated; reports not received.

City reports for week ended June 21, 1941—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Iowa:											
Cedar Rapids	1			4		0	0		0	0	
Davenport	0			1		0	0		1	0	
Des Moines	0			3		2	0		0	2	40
Sioux City	0			1		0	0		0	3	
Waterloo	0			19		1	0		0	6	
Missouri:											
Kansas City	0		1	62	4	3	0	1	0	7	80
St. Joseph	0		0	5	3	0	0	0	0	1	23
St. Louis	0		0	103	4	27	0	3	1	42	164
North Dakota:											
Fargo	0		0	0	1	0	0	0	0	9	12
Minot	0		0	2	0	0	0	0	0	4	5
South Dakota:											
Aberdeen	0			0		1	0		0	0	
Sioux Falls	0			0		0	0		0	0	6
Nebraska:											
Lincoln	0			0		3	0		0	4	
Omaha	1		0	0	2	2	0	2	0	0	63
Kansas:											
Lawrence	0		0	0	0	0	0	0	0	5	2
Topeka	0		0	17	2	0	0	0	0	43	11
Wichita	0		0	1	1	3	0	0	0	4	17
Delaware:											
Wilmington	0		0	3	0	3	0	1	0	0	27
Maryland:											
Baltimore	2	4	3	240	10	17	0	12	0	68	196
Cumberland	0		0	7	0	0	0	0	0	4	12
Frederick	0		0	1	0	0	0	0	0	1	
Dist. of Col.:											
Washington	1	1	1	111	2	6	0	11	0	10	162
Virginia:											
Lynchburg	0		0	23	0	0	0	0	0	3	9
Norfolk	0		0	7	2	0	0	1	1	5	27
Richmond	0		0	45	1	1	0	1	0	0	48
Roanoke	0		0	2	0	1	0	0	0	0	15
West Virginia:											
Charleston	0		0	0	0	0	0	0	0	4	10
Huntington	0			0		0	0		0	0	
Wheeling	0		0	26	0	0	0	0	0	3	16
North Carolina:											
Gastonia	0		0	6	2	0	0	0	0	0	6
Raleigh	0		0	9	0	0	0	0	0	13	7
Wilmington	0		0	12	1	0	0	0	0	23	7
Winston-Salem	0	1	1	12	0	0	0	2	0	2	18
South Carolina:											
Charleston	0		0	1	1	0	0	3	0	3	24
Florence	0	30	0	35	1	0	0	0	0	32	11
Greenville	0		0	1	0	1	0	0	0	0	12
Georgia:											
Atlanta	0		0	18	2	2	0	2	0	2	87
Brunswick	0		0	1	1	0	0	0	0	0	6
Savannah	0		0	7	1	2	0	0	1	2	33
Florida:											
Miami	0	1	1	3	0	1	0	2	0	6	36
St. Petersburg	0		0	4	0	0	0	1	0	0	15
Tampa											
Kentucky:											
Ashland	1		0	0	0	0	0	1	1	0	8
Covington	0		0	1	1	0	0	1	0	1	14
Lexington	0		0	1	0	0	0	0	0	6	12
Louisville	0		0	182	0	14	0	3	0	5	72
Tennessee:											
Knoxville	0		0	13	2	0	0	1	0	4	23
Memphis	0	3	1	45	0	0	2	7	0	27	88
Nashville	0		0	13	2	2	0	4	0	0	43
Alabama:											
Birmingham	0		0	9	4	1	0	3	1	0	60
Mobile	0		0	1	0	0	0	1	0	0	13
Montgomery	0			1		0	0		0	0	
Arkansas:											
Fort Smith	0			1		0	0		1	0	
Little Rock	0		0	8	5	0	0	0	0	3	37
Louisiana:											
Lake Charles	0		0	0	1	0	0	0	0	0	4
New Orleans	0	1	1	2	3	1	0	13	1	15	125
Shreveport	0		0	0	3	1	0	0	0	1	31

City reports for week ended June 21, 1941—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Oklahoma:											
Oklahoma City	2	4	0	14	1	0	0	1	0	0	47
Tulsa	0	-----	0	13	0	0	0	0	0	2	9
Texas:											
Dallas	1	-----	0	11	0	2	0	3	0	1	63
Fort Worth	0	-----	0	7	0	1	0	1	0	2	42
Galveston	0	-----	0	1	4	2	0	1	0	0	18
Houston	0	2	0	5	5	1	0	5	0	1	83
San Antonio	0	-----	0	0	4	0	0	9	0	7	82
Montana:											
Billings	0	-----	0	1	0	1	0	0	0	0	4
Great Falls	0	-----	0	2	1	2	0	0	0	0	3
Helena	0	-----	0	1	0	0	0	0	0	0	8
Missoula	0	-----	0	0	1	0	0	0	0	0	12
Idaho:											
Boise	0	-----	0	0	0	0	0	0	0	2	7
Colorado:											
Colorado Springs	0	-----	0	0	0	0	0	0	0	5	16
Denver	6	-----	0	72	1	3	0	2	0	100	70
Pueblo	1	-----	0	2	0	0	0	0	0	14	7
New Mexico:											
Albuquerque	0	-----	0	0	1	1	0	2	0	0	10
Arizona:											
Phoenix	0	23	-----	1	-----	2	0	-----	0	25	-----
Utah:											
Salt Lake City	0	-----	0	8	2	1	0	0	0	14	27
Washington:											
Seattle	0	-----	0	0	6	4	0	6	0	15	95
Spokane	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Tacoma	0	-----	0	1	1	0	0	0	0	11	24
Oregon:											
Portland	1	1	0	1	2	1	0	3	0	0	74
Salem	0	-----	-----	1	-----	0	0	-----	0	0	-----
California:											
Los Angeles	2	5	3	42	4	30	0	17	1	88	342
Sacramento	0	-----	0	4	1	3	0	2	0	8	35
San Francisco	0	2	1	0	1	4	0	4	1	32	146

State and city	Meningitis, meningococcus		Poliomyelitis cases
	Cases	Deaths	
Massachusetts:			
Boston	1	0	0
Rhode Island:			
Providence	1	0	0
Connecticut:			
New Haven	0	0	1
New York:			
New York	3	1	0
Pennsylvania:			
Pittsburgh	0	0	1
Illinois:			
Chicago	1	0	2
Minnesota:			
St. Paul	0	0	1
Missouri:			
Kansas City	1	0	0
Maryland:			
Baltimore	1	0	0
Cumberland	1	0	0
District of Columbia:			
Washington	1	0	0
Georgia:			
Atlanta	0	0	2
Alabama:			
Birmingham	0	0	1
Texas:			
Fort Worth	0	0	1
Arizona:			
Phoenix	0	0	1
Oregon:			
Salem	1	0	0
California:			
Los Angeles	0	0	1
San Francisco	1	0	1

Encephalitis, epidemic or lethargic.—Cases: San Antonio, 1; Albuquerque, 1. Deaths: New York, 3; Trenton, 1.

Pellagra.—Cases: Boston, 1; Charleston, S. C., 1; Florence, 1; Savannah, 3; Memphis, 1.

Typhus fever.—Cases: Miami, 3; Houston, 1. Deaths: Miami, 1.

TERRITORIES AND POSSESSIONS

HAWAII TERRITORY

Plague (rodent).—Rats proved positive for plague have been found in Paauhau Area of Hamakua District, Island of Hawaii, T. H., as follows: Kalopa Camp—May 26, 2 rats; May 29, 1 rat; Kalopa Homesteads—June 4, 1 rat; June 6, 1 rat; June 9, 2 rats; June 10, 1 rat; Paauhau—May 31, 1 rat; Paauhau Mill (vicinity of)—June 4, 1 rat.

Plague-infected fleas.—Fleas proved positive for plague by inoculation have been reported in Paauhau Area, Hamakua District, Island of Hawaii, T. H., as follows: Paauhau—April 30, 1941, 20 fleas from 29 rats; Kalopa—May 19, 1941, 21 fleas from 11 rats; May 24, 23 fleas from 26 rats; May 31, 61 fleas from 23 rats.

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Week ended June 7, 1941.—During the week ended June 7, 1941, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis		4	4	3	10			1	2	24
Chickenpox		20		156	292	79	57	47	58	709
Diphtheria		7	1	13	3	2				26
Influenza		3			5					8
Measles		33	49	495	1,245	84	34	36	154	2,130
Mumps	1	1	2	286	195	26	16	13	15	555
Pneumonia					12				7	19
Poliomyelitis									1	1
Scarlet fever		10	5	114	148	13	5	11	18	324
Tuberculosis		4	5	100	33	1		1		144
Typhoid and paratyphoid fever			2	9	4				1	16
Whooping cough				110	139		4	9	17	279

DENMARK

Notifiable diseases—January–March 1941.—During the months of January, February, and March 1941, cases of certain notifiable diseases were reported in Denmark as follows:

Disease	January	February	March	Disease	January	February	March
Cerebrospinal meningitis	9	18	41	Paratyphoid fever	6	3	2
Diphtheria	38	37	35	Poliomyelitis	1	4	1
Dysentery	29	104	53	Scarlet fever	585	451	427
Epidemic encephalitis	2	1	3	Syphilis	42	34	33
Influenza	11,805	30,262	54,380	Typhoid fever	4	1	1
Measles	4,754	3,466	2,900	Whooping cough	2,653	2,022	2,141

FINLAND

Communicable diseases—April 1941.—During the month of April 1941, cases of certain communicable diseases were reported in Finland as follows:

Disease	Cases	Disease	Cases
Diphtheria	214	Poliomyelitis	10
Influenza	2,898	Scarlet fever	350
Lethargic encephalitis	1	Typhoid fever	56
Paratyphoid fever	164		

JAMAICA

Communicable diseases—4 weeks ended June 7, 1941.—During the 4 weeks ended June 7, 1941, cases of certain communicable diseases were reported in Kingston, Jamaica, and in the island outside of Kingston, as follows:

Disease	Kingston	Other localities	Disease	Kingston	Other localities
Chickenpox		10	Puerperal fever		4
Diphtheria	2	1	Scarlet fever	1	2
Dysentery		1	Tuberculosis	28	76
Erysipelas	1		Typhoid fever	6	41
Leprosy		2			

VENEZUELA

Poliomyelitis.—During the period November 1, 1940, to March 15, 1941, a total of 166 cases of poliomyelitis with 20 deaths occurred in Venezuela, of which 122 cases with 15 deaths were reported in Caracas.

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—A cumulative table giving current information regarding the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS of June 27, 1941, pages 1347-1349. A similar table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Plague

China—Foochow.—During the week ended May 10, 1941, several cases of human plague were reported in Foochow, China. Rodent plague was also reported in Foochow during the same period.

Morocco—Casablanca.—A report dated June 23, 1941, stated that there had been an outbreak of bubonic plague at Casablanca, Morocco, where several deaths had occurred.

Peru.—During the month of April 1941, plague has been reported in Peru by Departments as follows: Ancash, 1 case; Lima, 1 case; Piura, 2 cases. Plague infection in rodents was also reported during the month in Lambayeque Department. During the month of May 1941, 4 cases of plague with 2 deaths were reported in the port of Ilo, Department of Moquegua, Peru.

Typhus Fever

Gibraltar.—During the week ended May 10, 1941, 2 cases of typhus fever were reported in Gibraltar.

Yellow Fever

Colombia.—During the month of March 1941, yellow fever was reported in Colombia as follows: Antioquia Department, 1 case, 1 death; Boyaca Department, 1 case, 1 death.

×